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SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Laura Deng Examiner #: 71726 Date: 6/25/03
 Art Unit: 170 Phone Number 30 64396 Serial Number: 09/961294
 Mail Box and Bldg/Rm Location: STC Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc., if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: See front SheetInventors (please provide full names): See front Sheet

Earliest Priority Filing Date: _____

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Coupled foam for a polymeric electrolyte comprising
 - a crosslinked polyether urethane prepared by
C1 2f3 reacting a prepolymer having polyether oxide
 back bone & terminated with NCO with
C1 4 a crosslinking agent
 - an organic Tertiary & Iminium Salt C1 5
 -

Thanks,
 Laura

STAFF USE ONLY

Type of Search

Vendors and cost where applicable

Searcher: K. Fuller

AA Sequence (#)

STN

Searcher Phone #:

Dialog

Searcher Location:

Questel/Orbit

Date Searcher Picked Up:

Dr. Link

Date Completed: 6/26/03

Lexis/Nexis

Searcher Prep & Review Time: 20

Fulltext

Sequence Systems

Clerical Prep Time:

Patent Family

WWW/Internet

Online Time: 21

Other

Other (specify)

WEINER 09/961294 Page 1

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DICTIONARY FILE UPDATES: 25 JUN 2003 HIGHEST RN 537653-06-8

TSCA INFORMATION NOW CURRENT THROUGH JANUARY 6, 2003

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Crossover limits have been increased. See HELP CROSSOVER for details.

Experimental and calculated property data are now available. See HELP PROPERTIES for more information. See STNote 27, Searching Properties in the CAS Registry File, for complete details:
<http://www.cas.org/ONLINE/STN/STNOTES/stnotes27.pdf>

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FILE COVERS 1907 - 26 Jun 2003 VOL 138 ISS 26
FILE LAST UPDATED: 25 Jun 2003 (20030625/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> d que 121
L2 32 SEA FILE=REGISTRY ABB=ON (25322-68-3/BI OR 7439-93-2/BI OR 101-68-8/BI OR 105-58-8/BI OR 108-32-7/BI OR 12190-79-3/BI OR 132902-95-5/BI OR 14283-07-9/BI OR 21324-40-3/BI OR 25322-69-4/BI OR 25791-96-2/BI OR 26851-39-8/BI OR 31694-55-0/BI OR 33454-82-9/BI OR 4098-71-9/BI OR 502-44-3/BI OR 56-87-1/BI OR 584-84-9/BI OR 616-38-6/BI OR 623-53-0/BI OR 64743-80-2/BI OR 70198-24-2/BI OR 7564-64-9/BI OR 7791-03-9/BI OR 79371-37-2/BI OR 822-06-0/BI OR 872-36-6/BI OR 9002-88-4/BI OR 9003-07-0/BI OR 90076-65-6/BI OR 91-08-7/BI OR 96-49-1/BI)

L3	7 SEA FILE=REGISTRY ABB=ON	L2 AND 1/LI
L4	10 SEA FILE=REGISTRY ABB=ON	L2 AND ISOCYAN?
L5	1 SEA FILE=REGISTRY ABB=ON	"POLYETHYLENE OXIDE"/CN
L6	1 SEA FILE=REGISTRY ABB=ON	"POLYPROPYLENE GLYCOL"/CN
L7	1 SEA FILE=REGISTRY ABB=ON	"POLYETHYLENE GLYCOL"/CN
L8	2 SEA FILE=REGISTRY ABB=ON	(L5 OR L6 OR L7)
L9	230404 SEA FILE=HCAPLUS ABB=ON	L4 OR NCO OR ?URETHAN? OR ?ISOCYANAT?
L10	182644 SEA FILE=HCAPLUS ABB=ON	L8 OR POLYETHYLENE OXIDE OR POLYOXYALKYLENE# OR (POLYPROPYLENE OR POLYETHYLENE) (W) GLYCOL OR POLYOXYETHYLENE OR POLYOXYPROPYLENE
L11	26104 SEA FILE=HCAPLUS ABB=ON	L9 AND L10
L12	342226 SEA FILE=HCAPLUS ABB=ON	L3 OR LI OR LITHIUM
L13	554 SEA FILE=HCAPLUS ABB=ON	L11 AND L12
L14	152 SEA FILE=HCAPLUS ABB=ON	L13 AND CROSSLINK?
L15	18646 SEA FILE=HCAPLUS ABB=ON	POLYMER?(S) ELECTROLYTE?
L16	82 SEA FILE=HCAPLUS ABB=ON	L14 AND L15
L17	21659 SEA FILE=HCAPLUS ABB=ON	L9(L)L10
L18	61 SEA FILE=HCAPLUS ABB=ON	L16 AND L17
L19	24 SEA FILE=HCAPLUS ABB=ON	L18 AND (PREP OR SPN OR IMF)/RL
L20	33 SEA FILE=HCAPLUS ABB=ON	L18 AND BATTER?
L21	44 SEA FILE=HCAPLUS ABB=ON	L19 OR L20

=> d 121 1-44 all hitstr

L21 ANSWER 1 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2003:222725 HCAPLUS
 DN 138:386197
 TI Phase transfer catalytic property and ion conductivity of polyoxyethylene-containing interpenetrating polymer networks and of their LiClO₄ complexes
 AU Xie, Hong-Quan; Wang, Guigui
 CS Department of Chemistry, Huazhong University of Science and Technology, Wuhan, 430074, Peop. Rep. China
 SO Polymeric Materials Science and Engineering (2003), 88, 372-373
 CODEN: PMSEDG; ISSN: 0743-0515
 PB American Chemical Society
 DT Journal; (computer optical disk)
 LA English
 CC 37-5 (Plastics Manufacture and Processing)
 Section cross-reference(s): 38, 45
 AB Simultaneous grafted interpenetrating polymer networks (IPNs) based on (castor oil-polyethylene glycol) polyurethane and poly[alkyl (meth)acrylate] were synthesized by coupling castor oil and polyethylene glycol (PEG) with 2,4-toluene diisocyanate and by radical polymn. of alkyl (meth)acrylate with castor oil simultaneously at ambient temp. The gel contents of the IPNs were higher about 96% in most cases. The IPN was characterized by IR spectrum. Effects of compositional variation of the IPNs on phase transfer catalytic efficiency and mech. properties, as well as cond. of the IPNs complexed with LiClO₄ were studied. The results showed that the IPNs have good phase transfer catalytic ability in the Williamson reaction and exhibited a max. conversion of potassium phenolate at 55% PEO. The phase transfer catalytic ability of the IPN increases with mol. wt. of PEG used in the IPN synthesis and with the length of alkyl groups of the grafts, but decreases with increasing crosslinking degree. The complex of the IPNs with LiClO₄ exhibited good ionic cond. in the range of

10-5 S/cm to 3×10^{-4} S/cm, which decreases with increasing either the **crosslinking** degree or the mol. wt. of PEG used, but increases with increasing PEO content. The more the compatibility of the grafts with PEO, the lower is the cond. Bu methacrylate or Et methacrylate is better to be used as the monomer in synthesis of the IPNs for phase transfer catalyst and ion conducting material. The IPNs showed high tensile strength in the range of 10-20 MPa. The good mech. properties of the IPNs favor the application of them as a strong solid **polymer electrolyte** film and an easily recoverable phase transfer catalyst.

- ST **polyoxyethylene polyurethane** interpenetrating network lithium complex; ionic cond **polyoxyethylene polyurethane** interpenetrating network lithium; polymethacrylate interpenetrating network lithium complex **polyoxyethylene**; polyacrylate interpenetrating network lithium complex **polyoxyethylene**; phase transfer catalyst Williamson reaction lithium
- IT Alkoxylation catalysts
(Williamson; phase-transfer catalytic property and ion cond. of **polyoxyethylene**-contg. interpenetrating polymer networks and of their LiClO₄ complexes)
- IT Interpenetrating polymer networks
Ionic conductivity
Polymer electrolytes
Tensile strength
(phase-transfer catalytic property and ion cond. of **polyoxyethylene**-contg. interpenetrating polymer networks and of their LiClO₄ complexes)
- IT Castor oil
RL: CAT (Catalyst use); POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(polymers with TDI and **polyethylene glycol**; phase-transfer catalytic property and ion cond. of **polyoxyethylene**-contg. interpenetrating polymer networks and of their LiClO₄ complexes)
- IT **Polyoxyalkylenes**, preparation
RL: CAT (Catalyst use); POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(polymers with castor oil and TDI, lithium complexes; phase-transfer catalytic property and ion cond. of **polyoxyethylene**-contg. interpenetrating polymer networks and of their LiClO₄ complexes)
- IT **Polyurethanes**, preparation
RL: CAT (Catalyst use); POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(**polyoxyalkylene**-; phase-transfer catalytic property and ion cond. of **polyoxyethylene**-contg. interpenetrating polymer networks and of their LiClO₄ complexes)
- IT **7439-93-2DP, Lithium**, complexes with **polyethylene glycol**-contg. **polyurethanes**
9003-20-7P, Poly(vinyl acetate) 9003-32-1P, Poly(ethyl acrylate)
9003-42-3P, Poly(ethyl methacrylate) 9003-49-0P, Poly(butyl acrylate)
9011-14-7P, PMMA **25322-68-3DP, Polyethylene glycol**, polymers with castor oil and TDI, lithium complexes 26471-62-5DP, TDI, polymers with castor oil and

polyethylene glycol, lithium complexes

RL: CAT (Catalyst use); POF (Polymer in formulation); PRP (Properties);
SPN (Synthetic preparation); PREP (Preparation); USES
 (Uses)

(phase-transfer catalytic property and ion cond. of
polyoxyethylene-contg. interpenetrating polymer networks and of
 their LiClO₄ complexes)

IT 100-67-4, Potassium phenolate 109-65-9, n-Butyl bromide

RL: RCT (Reactant); RACT (Reactant or reagent)

(phase-transfer catalytic property and ion cond. of
polyoxyethylene-contg. interpenetrating polymer networks and of
 their LiClO₄ complexes)

RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Grosz, M; Polym Prepr 1997, V38(1), P612 HCPLUS
- (2) Guler, H; J Appl Polym Sci 1997, V66(13), P2475 HCPLUS
- (3) Kim, J; J Biomater Sci Polym Ed 2000, V11(2), P197 HCPLUS
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- (5) Pitsikalis, M; Adv Polym Sci 1998, V135, P1 HCPLUS
- (6) Velichkova, R; Progr Polym Sci 1995, V20, P819 HCPLUS
- (7) Wang, M; Guizhou Gongxueyuan Xuebao 1995, V24(5), P8 HCPLUS
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- (9) Xie, H; Prog Polym Sci 1999, V24, P275 HCPLUS

IT 7439-93-2DP, Lithium, complexes with

polyethylene glycol-contg. **polyurethanes**
25322-68-3DP, Polyethylene glycol, polymers
 with castor oil and TDI, lithium complexes

RL: CAT (Catalyst use); POF (Polymer in formulation); PRP (Properties);
SPN (Synthetic preparation); PREP (Preparation); USES
 (Uses)

(phase-transfer catalytic property and ion cond. of
polyoxyethylene-contg. interpenetrating polymer networks and of
 their LiClO₄ complexes)

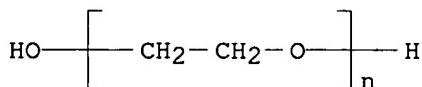
RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

RN 25322-68-3 HCPLUS

CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



L21 ANSWER 2 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 2002:916784 HCPLUS

DN 138:272294

TI Novel gel **polymer electrolytes** based on a cellulose ester with PEO side chains

AU Yue, Z.; McEwen, I. J.; Cowie, J. M. G.

CS Department of Chemistry, Heriot-Watt University, Edinburgh, EH14 4AS, UK

SO Solid State Ionics (2003), 156(1,2), 155-162
 CODEN: SSIOD3; ISSN: 0167-2738

PB Elsevier Science B.V.
 DT Journal
 LA English
 CC 37-5 (Plastics Manufacture and Processing)
 Section cross-reference(s): 52, 76

AB A range of gel electrolytes, composed of a hydroxypropyl cellulose esters with oligomeric poly(oxyethylene) side chains, LiCF₃SO₃, and propylene carbonate (PrC), or a mixt. of PrC with ethylene carbonate (EtC), were prep'd. and studied. The conductivities of gels contg. 10% LiCF₃SO₃, and having PrC concns. varying from 20-70%, exhibit Arrhenius behavior with activation energies ranging from 16-34 kJ mol⁻¹. Room temp. conductivities of the order of 10⁻³ S cm⁻¹ are achieved with PrC contents above 50%. Gels contg. 70% PrC, or a mixts. of PrC and EtC, were **crosslinked** to form elastomeric films exhibiting good mech. properties and room temp. conductivities of apprx. 10⁻³ S cm⁻¹. The conductivities and mech. strength of these films increased with increasing EtC content. An Arrhenius dependence of log cond. on (1/T) is also obsd. in these films, with activation energies for ion transport around 16 kJ mol⁻¹.

ST hydroxypropyl cellulose **polyoxyethylene** ester electrolyte ionic cond

IT Glass transition temperature
 Ionic conductivity
Polymer electrolytes
 Stress-strain relationship
 (prepn. and properties of **Polymer electrolyte** gels based on hydroxypropyl cellulose **Polyoxyethylene** esters)

IT 33454-82-9, Lithium triflate
 RL: MOA (Modifier or additive use); USES (Uses)
 (dopant; prepn. and properties of **Polymer electrolyte** gels based on hydroxypropyl cellulose **Polyoxyethylene** esters)

IT 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate
 RL: MOA (Modifier or additive use); USES (Uses)
 (plasticizer; prepn. and properties of **Polymer electrolyte** gels based on hydroxypropyl cellulose **Polyoxyethylene** esters)

IT 7439-93-2DP, Lithium, complexes with **Crosslinked** cellulose ester with poly(ethylene oxide) side chains 503534-39-2DP, Tris(hydroxypropyl) cellulose ester with .alpha.- (carboxymethyl)-.omega.-methoxypoly(oxy-1,2-ethanediyl)-hexamethylene **diisocyanate** copolymer, lithium complexes
 RL: POF (Polymer in formulation); PRP (Properties); SPN (**Synthetic preparation**); PREP (**Preparation**); USES (Uses)
 (prepn. and properties of **Polymer electrolyte** gels based on hydroxypropyl cellulose **Polyoxyethylene** esters)

RE.CNT 23 THERE ARE 23 CITED REFERENCES AVAILABLE FOR THIS RECORD
 RE

- (1) Abbrent, S; Electrochim Acta 1998, V43, P1185 HCPLUS
- (2) Anon; IUPAC Acid--Base Dissociation Constants in Dipolar Aprotic Solvents 1990
- (3) Cameron, G; Polymer Electrolyte Reviews 1989, V2
- (4) Cowie, J; Br Polym J 1988, V20, P247 HCPLUS
- (5) Cowie, J; Macromol Symp 1995, V98, P843 HCPLUS
- (6) Cowie, J; Polymer 1989, V30, P509 HCPLUS
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- (8) Crank, J; The Mathematics of Diffusion, 2nd ed 1995

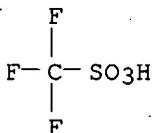
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 (11) Forsyth, M; *Electrochim Acta* 1995, V40, P2349 HCPLUS
 (12) Gray, F; *Solid Polymer Electrolytes: Fundamentals and Technological Applications* 1991
 (13) Hirahara, K; *Extended Abstract of the Ninth International Meeting on Lithium Batteries* 1998
 (14) Huang, W; *Electrochim Acta* 1995, V40, P2147 HCPLUS
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 (16) Kono, M; *Electrochim Acta* 2000, V45, P1307 HCPLUS
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 (18) MacFarlane, D; *Electrochim Acta* 1995, V13, P2333
 (19) Murata, K; *Electrochim Acta* 2000, V45, P1501 HCPLUS
 (20) Song, J; *J Power Sources* 1999, V77, P183 HCPLUS
 (21) Sun, X; *Solid State Ionics* 1996, V83, P79 HCPLUS
 (22) Wright, P; *Electrochim Acta* 1998, V43, P1137 HCPLUS
 (23) Yue, Z; *Polymer* (in press)

IT 33454-82-9, Lithium triflate

RL: MOA (Modifier or additive use); USES (Uses)
 (dopant; prepn. and properties of **polymer electrolyte**
 gels based on hydroxypropyl cellulose **polyoxyethylene esters**)

RN 33454-82-9 HCPLUS

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

IT 7439-93-2DP, Lithium, complexes with **crosslinked**
 cellulose ester with poly(ethylene oxide) side chains
 RL: POF (Polymer in formulation); PRP (Properties); SPN (**Synthetic preparation**); PREP (**Preparation**); USES (Uses)
 (prepn. and properties of **polymer electrolyte** gels
 based on hydroxypropyl cellulose **polyoxyethylene esters**)

RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 3 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 2002:734227 HCPLUS
 DN 137:256174
 TI **Crosslinked** conductive polymers with stable conductivity under
 various conditions having flexible **polyoxyalkylene-polycarbonate**
 groups
 IN Kijima, Tetsuo; Toyama, Yasunori; Akimoto, Mamoru; Nozu, Takashi;
 Kobayashi, Toshihide

PA Nippon Polyurethane Industry Co., Ltd., Japan
 SO Jpn. Kokai Tokkyo Koho, 13 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01B001-12
 ICS C08F002-44; C08F220-28; C08F287-00; C08F290-14; C08G018-38;
 C08G018-46; C08G018-50; H01M010-40
 CC 76-2 (Electric Phenomena)
 Section cross-reference(s): 38

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2002279827	A2	20020927	JP 2001-76344	20010316
PRAI	JP 2001-76344		20010316		

AB The **crosslinked** polymers, useful for **batteries**,
 capacitors, etc., comprise compds. having a structure unit
 $R_1(O R_2)_n O(R_3OCO_2)_m$ ($R_1 = C_1-5$ -alkyl; $R_2, R_3 = C_2-10$ -linear, branched,
 cyclic aliph. group; $m, n \geq 1$) and compds. having multiple
 polymerizable groups. The **polyoxyalkylene-polycarbonate** groups
 may be linked with the main chains via acryloyl groups or carbamate
 groups.

ST conductive polymer **polyoxyalkylene polycarbonate** flexible
 pendant; **polymer electrolyte crosslinked**
 cond stability

IT **Polymer electrolytes**
 (crosslinked polymer electrolytes with
 stable cond. having flexible **polyoxyalkylene-polycarbonate**
 groups)

IT **Polyoxyalkylenes**, uses
 RL: TEM (Technical or engineered material use); USES (Uses)
 (polycarbonate-, acrylic; **crosslinked polymer**
electrolytes with stable cond. having flexible
polyoxyalkylene-polycarbonate groups)

IT **Polyurethanes**, uses
 RL: IMF (Industrial manufacture); TEM (Technical or engineered
 material use); PREP (Preparation); USES (Uses)
 (polycarbonate-polyoxyalkylene-; **crosslinked**
polymer electrolytes with stable cond. having
 flexible **polyoxyalkylene-polycarbonate** groups)

IT **Polyoxyalkylenes**, uses
 RL: IMF (Industrial manufacture); TEM (Technical or engineered
 material use); PREP (Preparation); USES (Uses)
 (polycarbonate-polyurethane-; **crosslinked**
polymer electrolytes with stable cond. having
 flexible **polyoxyalkylene-polycarbonate** groups)

IT Polycarbonates, uses
 RL: TEM (Technical or engineered material use); USES (Uses)
 (polyoxyalkylene-, acrylic; **crosslinked**
polymer electrolytes with stable cond. having
 flexible **polyoxyalkylene-polycarbonate** groups)

IT Polycarbonates, uses
 RL: IMF (Industrial manufacture); TEM (Technical or engineered
 material use); PREP (Preparation); USES (Uses)
 (polyoxyalkylene-polyurethane-; **crosslinked**
polymer electrolytes with stable cond. having
 flexible **polyoxyalkylene-polycarbonate** groups)

IT 460986-47-4DP, Diethyl carbonate-ethoxylated glycerin-1,6-hexanediol-MDI

copolymer, carbamates with **polyethylene glycol**
monomethyl ether 460986-48-5DP, carbamates with **polyethylene glycol** monomethyl ether 460986-49-6DP, carbamates with **polyethylene glycol** monomethyl ether 460986-50-9DP,
carbamates with **polyethylene glycol** monomethyl ether
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(crosslinked polymer electrolytes with
stable cond. having flexible **polyoxyalkylene-polycarbonate**
groups)

- IT 7439-93-2, Lithium, uses
RL: MOA (Modifier or additive use); TEM (Technical or engineered material use); USES (Uses)
(dopant; crosslinked polymer electrolytes
with stable cond. having flexible **polyoxyalkylene**
-polycarbonate groups)
- IT 7439-93-2, Lithium, uses
RL: MOA (Modifier or additive use); TEM (Technical or engineered material use); USES (Uses)
(dopant; crosslinked polymer electrolytes
with stable cond. having flexible **polyoxyalkylene**
-polycarbonate groups)
- RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

- L21 ANSWER 4 OF 44 HCAPLUS COPYRIGHT 2003 ACS
AN 2002:727146 HCAPLUS
DN 137:248720
TI Crosslinkable polycarbonates with good stability and weather resistance
IN Kijima, Tetsuo; Toyama, Yasunori; Akimoto, Mamoru; Nozu, Takashi;
Kobayashi, Toshihide
PA Nippon Polyurethane Industry Co., Ltd., Japan
SO Jpn. Kokai Tokyo Koho, 12 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C08G018-44
ICS C08F299-02; H01B001-06; H01M004-62; H01M008-02; H01M010-40
CC 38-3 (Plastics Fabrication and Uses)
Section cross-reference(s): 52
FAN.CNT 1
- | PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|--------------------|--|----------|-----------------|----------|
| PI JP 2002275234 | A2 | 20020925 | JP 2001-76375 | 20010316 |
| PRAI JP 2001-76375 | | 20010316 | | |
| AB | The polycarbonates, useful as electrode binders, polymer electrolytes for secondary batteries , etc., are prep'd.
by polymn. of polycarbonates contg. $(R_1OCO_2)_m$ and $(R_2OCO_2)_n$ [R_1 = hetero atom-contg. C2-10 divalent group; R_2 = hetero atom-contg. cyclic or branched C2-10 divalent group; $m, n > 0$]. Thus, a soln. contg. a polycarbonate diol (M_n 500, m/n 7/3) prep'd. from 1,6-hexamethylenediol, 3-methyl-1,5-pentanediol, and di-Et carbonate, MDI, ethoxylated glycerin, | | | |

and LiCF₃SO₃ as a dopant was applied on an electrode and cured to give a crosslinked polymer electrolyte with ion cond.
at 25.degree. and relative humidity 55% 2 .times. 10⁻⁴ Scm⁻¹.

ST crosslinked polymer polycarbonate electrode binder secondary battery; hexamethylenediol methylpentanediol carbonate MDI polyoxyethylene glycerin polymer; polymer electrolyte lithium fluoromethanesulfonate polyoxyethylene polycarbonate complex

IT Battery electrodes
 Battery electrolytes
 Secondary batteries
 (crosslinkable polycarbonates with good stability and weather resistance)

IT Binders
 (for secondary battery electrode; crosslinkable polycarbonates with good stability and weather resistance)

IT Polymer electrolytes
 (for secondary battery; crosslinkable polycarbonates with good stability and weather resistance)

IT Polyurethanes, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polycarbonate-; crosslinkable polycarbonates with good stability and weather resistance)

IT Polyurethanes, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polycarbonate-polyether-, lithium complexes,
 trifluoromethanesulfonate-contg.; crosslinkable polycarbonates with good stability and weather resistance)

IT Polyurethanes, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polycarbonate-polyoxyalkylene-, lithium complexes,
 trifluoromethanesulfonate-contg.; crosslinkable polycarbonates with good stability and weather resistance)

IT Polyethers, uses
 Polyoxyalkylenes, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polycarbonate-polyurethane-, lithium complexes,
 trifluoromethanesulfonate-contg.; crosslinkable polycarbonates with good stability and weather resistance)

IT Polycarbonates, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polyether-polyurethane-, lithium complexes,
 trifluoromethanesulfonate-contg.; crosslinkable polycarbonates with good stability and weather resistance)

IT Polycarbonates, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (poxyalkylene-polyurethane-, lithium complexes, trifluoromethanesulfonate-contg.; crosslinkable polycarbonates with good stability and weather resistance)

IT Polycarbonates, uses
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polyurethane-; crosslinkable polycarbonates with good stability and weather resistance)

IT 140936-35-2P 461317-47-5P 461317-52-2P 461317-57-7P
 RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
 (crosslinkable polycarbonates with good stability and weather resistance)

IT 7439-93-2DP, Lithium, polyoxyethylene
 -polycarbonate complexes, trifluoromethanesulfonate-contg.
 460986-49-6DP, lithium complexes, trifluoromethanesulfonate-contg. 461317-67-9DP, lithium complexes, trifluoromethanesulfonate-contg. 461317-73-7DP, lithium complexes, trifluoromethanesulfonate-contg. 461317-78-2DP, lithium complexes, trifluoromethanesulfonate-contg. 461317-83-9P
 RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (crosslinkable polycarbonates with good stability and weather resistance)

IT 7439-93-2DP, Lithium, polyoxyethylene
 -polycarbonate complexes, trifluoromethanesulfonate-contg.
 RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (crosslinkable polycarbonates with good stability and weather resistance)

RN 7439-93-2 HCAPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 5 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2002:573561 HCAPLUS
 DN 137:143032
 TI Polymer solid electrolyte, electrochemical element using the electrolyte, and secondary battery
 IN Maeda, Seiji; Saito, Takaichiro
 PA Nippon Synthetic Chemical Industry Co., Ltd., Japan
 SO Jpn. Kokai Tokyo Koho, 12 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01M010-40
 ICS C08F002-44; C08F002-50; C08F290-06; C08F299-02; C08K005-00;
 C08L071-00; H01B001-06
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 2002216845	A2	20020802	JP 2001-10621	20010118
PRAI JP 2001-10621		20010118		

AB The electrolyte has an electrolyte salt in a polymer matrix, which is a crosslinked copolymer of a urethane (meth)acrylate and monomer $\text{CH}_2:\text{CRCO}[(\text{OCH}_2\text{CH}_2)^k(\text{OC}_3\text{H}_6)^l(\text{OC}_2\text{H}_2\text{CH}_2\text{CH}_2\text{CH}_2)^m]\text{OR}'$, where R = H or Me, R' = H, C1-18 (branched) alkyl group, k, l, and m = integers and $(k+l+m) \geq 1$. The electrochem. element and secondary Li battery use the electrolyte.

ST secondary lithium battery electrolyte acrylate
 crosslinked copolymer; urethane polyoxyalkylene
 acrylate crosslinked copolymer battery electrolyte;
 electrochem element electrolyte acrylate crosslinked copolymer

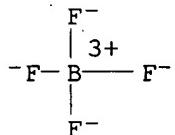
IT Battery electrolytes
 (electrolytes contg. urethane acrylate-oxyalkylene acrylate
 crosslinked copolymer matrixes for secondary lithium
 batteries)

IT 14283-07-9, Lithium fluoroborate 90076-65-6
 444815-77-4 444815-78-5 444815-79-6
 RL: DEV (Device component use); USES (Uses)
 (electrolytes contg. urethane acrylate-oxyalkylene acrylate
 crosslinked copolymer matrixes for secondary lithium
 batteries)

IT 14283-07-9, Lithium fluoroborate 90076-65-6
 RL: DEV (Device component use); USES (Uses)
 (electrolytes contg. urethane acrylate-oxyalkylene acrylate
 crosslinked copolymer matrixes for secondary lithium
 batteries)

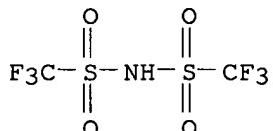
RN 14283-07-9 HCAPLUS

CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



RN 90076-65-6 HCAPLUS

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



L21 ANSWER 6 OF 44 HCAPLUS COPYRIGHT 2003 ACS

AN 2002:276449 HCAPLUS

DN 136:312572

TI Solid polymer electrolytes using polyether poly
 (N-substituted urethane)

IN Noh, Si-tae; Kweon, Jung-ohk; Choi, Hee Sung

PA S. Korea

SO U.S. Pat. Appl. Publ., 13 pp.
CODEN: USXXCO

DT Patent

LA English

IC ICM H01M010-40

NCL 429314000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 72, 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2002042002	A1	20020411	US 2001-968734	20011001
PRAI	KR 2000-57810	A	20001002		
	KR 2000-62811	A	20001025		

AB The present invention relates to a solid **polymer electrolyte** of polyether poly(N-substituted urethane) comprising an electrolytic compd. and a **polymer** matrix, wherein the **polymer** matrix is a copolymer comprising polyether unit and **polyurethane** unit and has 50,000-2,000,000 of a wt. av. mol. wt., where N-positions of the **polyurethane** unit are substituted with oligo(ethylene oxide) derivs. which provide flexibility and electrolytic conduction of the **polymer** matrix by controlling its length, compon., structure and **crosslinked** degree. Accordingly, the solid **polymer electrolyte** of the present invention provides excellent thermal stability, electrochem. stability and mech. properties and thus, is suitable for use in **polymer** secondary batteries and electrochem. devices.

ST battery polymer electrolyte polyether polyurethane; electrochem device polymer electrolyte polyether polyurethane

IT Ceramics

(filler; solid **polymer electrolytes** using polyether poly (N-substituted urethane))

IT Zeolites (synthetic), uses

RL: MOA (Modifier or additive use); USES (Uses)
(filler; solid **polymer electrolytes** using polyether poly (N-substituted urethane))

IT **Polyurethanes**, uses

RL: DEV (Device component use); USES (Uses)
(polyether-; solid **polymer electrolytes** using polyether poly (N-substituted urethane))

IT **Battery electrolytes**

Capacitors

Glass transition temperature

Ionic conductivity

Polymer electrolytes

Secondary batteries

Sensors

(solid **polymer electrolytes** using polyether poly (N-substituted urethane))

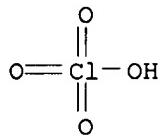
IT 1344-28-1, Alumina, uses 7631-86-9, Silica, uses 37220-89-6,
Lithium aluminate

RL: MOA (Modifier or additive use); USES (Uses)
(filler; solid **polymer electrolytes** using polyether poly (N-substituted urethane))

IT 9004-74-4P, **Polyethylene glycol** monomethyl ether

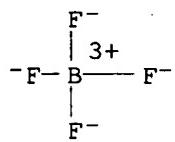
RL: DEV (Device component use); SPN (Synthetic preparation);
PREP (Preparation); USES (Uses)

- (polyether poly(N-substituted urethane) with; solid polymer electrolytes using polyether poly (N-substituted urethane))
- IT 816-43-3, Lithium diethylamide 865-47-4 1024-41-5, Benzyl tosylate 7782-89-0, Lithium amide 39794-77-9 68211-49-4, 1-Naphthyl tosylate 102242-35-3, 9-Anthryl tosylate
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(solid polymer electrolytes using polyether poly (N-substituted urethane))
- IT 96-48-0, .gamma.-Butyrolactone 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 110-71-4 616-38-6, Dimethyl carbonate 623-53-0, Ethyl methyl carbonate 623-96-1, Dipropyl carbonate 7791-03-9, Lithium perchlorate 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate 33454-82-9, Lithium triflate 73506-93-1, Diethoxyethane 90076-65-6, Lithium bis(trifluoromethanesulfonyl)imide
RL: DEV (Device component use); USES (Uses)
(solid polymer electrolytes using polyether poly (N-substituted urethane))
- IT 25036-33-3DP, N-Bu deriv. 25036-33-3DP, Ethylene glycol-bis(4-isocyanatophenyl)methane copolymer, N-Me deriv. 25036-33-3DP, reaction product of potassium tert-butanolate and polyethylene glycol ditosylate 25036-33-3DP, reaction product of tosyl heptaoxyethylene Me ether and oligooxyethylene ditosylate 25036-33-3DP, reaction product of tosyl trioxyethylene Me ether and oligooxyethylene ditosylate 93228-39-8DP, derivs.
RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(solid polymer electrolytes using polyether poly (N-substituted urethane))
- IT 7791-03-9, Lithium perchlorate 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethanesulfonyl)imide
RL: DEV (Device component use); USES (Uses)
(solid polymer electrolytes using polyether poly (N-substituted urethane))
- RN 7791-03-9 HCPLUS
CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



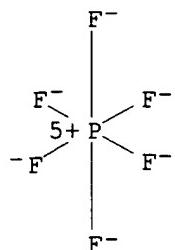
Li

- RN 14283-07-9 HCPLUS
CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



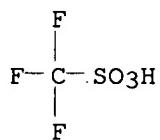
Li^+

RN 21324-40-3 HCPLUS
CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



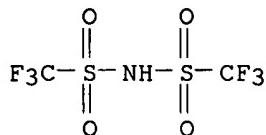
Li^+

RN 33454-82-9 HCPLUS
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 90076-65-6 HCPLUS
CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

L21 ANSWER 7 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2002:276448 HCAPLUS
 DN 136:312571
 TI **Lithium battery with polymeric electrolyte**
Applicant
 IN Lee, Jin-young
 PA S. Korea
 SO U.S. Pat. Appl. Publ., 8 pp.
 CODEN: USXXCO
 DT Patent
 LA English
 IC ICM H01M010-40
 NCL 429314000
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2002042001	A1	20020411	US 2001-961294	20010925
	CN 1345897	A	20020424	CN 2001-125708	20010820
	JP 2002187925	A2	20020705	JP 2001-301867	20010928
PRAI	KR 2000-57340	A	20000929		

AB A **polymeric electrolyte** and a **lithium battery** employing the same are disclosed. The **polymeric electrolyte** includes a **crosslinked polyether urethane** prep'd. by reacting a **pre-polymer** having a **polyethylene oxide** backbone and terminated with **NCO**, with a **crosslinking agent**, org. solvent and **lithium salt**. Since the **polymeric electrolyte** is electrochem. stable, a **lithium battery** having improved reliability and safety can be obtained by employing the **polymeric electrolyte**.

ST **lithium battery polymer electrolyte**
; safety lithium battery polymer electrolyte

IT Cycloalkanes
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (bicyclic, heptane **trisocyanate** derivs.; **lithium battery with polymeric electrolyte**)

IT Bicyclic compounds
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (cycloalkanes, heptane **trisocyanate** derivs.; **lithium battery with polymeric electrolyte**)

IT **Polyoxyalkylenes**, reactions
 RL: RCT (Reactant); RACT (Reactant or reagent)

- (isocyanate-terminated; lithium battery
with polymeric electrolyte)
- IT Battery electrolytes
 Polymer electrolytes
 (lithium battery with polymeric
 electrolyte)
- IT Polyoxalkylenes, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
 (lithium battery with polymeric
 electrolyte)
- IT Polyoxalkylenes, uses
RL: DEV (Device component use); SPN (Synthetic preparation);
PREP (Preparation); USES (Uses)
 (lithium complex; lithium battery with
 polymeric electrolyte)
- IT Secondary batteries
 (lithium; lithium battery with
 polymeric electrolyte)
- IT Polyurethanes, uses
RL: DEV (Device component use); USES (Uses)
 (polyether-; lithium battery with polymeric
 electrolyte)
- IT 502-44-3, Caprolactone 7564-64-9, 3-Methyl-1,3,5-pentanetriol
25791-96-2 31694-55-0
RL: RCT (Reactant); RACT (Reactant or reagent)
 (crosslinking agent; lithium battery with
 polymeric electrolyte)
- IT 108-32-7, Propylene carbonate 7439-93-2, Lithium, uses
7791-03-9, Lithium perchlorate 9002-88-4, Polyethylene
9003-07-0, Polypropylene 12190-79-3, Cobalt lithium
oxide colio2 14283-07-9, Lithium tetrafluoroborate
21324-40-3, Lithium hexafluorophosphate
33454-82-9, Lithium triflate 90076-65-6
RL: DEV (Device component use); USES (Uses)
 (lithium battery with polymeric
 electrolyte)
- IT 7439-93-2DP, Lithium, polyethylene
oxide complex 25322-68-3DP, Polyethylene
glycol, lithium complex
RL: DEV (Device component use); SPN (Synthetic preparation);
PREP (Preparation); USES (Uses)
 (lithium battery with polymeric
 electrolyte)
- IT 96-49-1, Ethylene carbonate 105-58-8, Diethyl carbonate 616-38-6,
Dimethyl carbonate 623-53-0, Ethyl methyl carbonate 872-36-6, Vinylene
carbonate
RL: DEV (Device component use); TEM (Technical or engineered material
use); USES (Uses)
 (lithium battery with polymeric
 electrolyte)
- IT 56-87-1D, Lysine, esters triisocyanate derivs. 91-08-7
, Tolylene 2,6-diisocyanate 101-68-8, Diphenylmethane
4,4'-diisocyanate 584-84-9, Tolylene 2,4-
diisocyanate 822-06-0, Hexamethylene
diisocyanate 4098-71-9, Isophorone diisocyanate
25322-68-3D, Peo, isocyanate-terminated
25322-69-4, Polypropylene glycol
26851-39-8 64743-80-2 70198-24-2

79371-37-2 132902-95-5

RL: RCT (Reactant); RACT (Reactant or reagent)
 (lithium battery with polymeric
 electrolyte)

IT 7439-93-2, Lithium, uses 7791-03-9,
 Lithium perchlorate 12190-79-3, Cobalt lithium
 oxide colio2 14283-07-9, Lithium tetrafluoroborate
 21324-40-3, Lithium hexafluorophosphate
 33454-82-9, Lithium triflate 90076-65-6
 RL: DEV (Device component use); USES (Uses)
 (lithium battery with polymeric
 electrolyte)

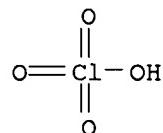
RN 7439-93-2 HCAPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

RN 7791-03-9 HCAPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

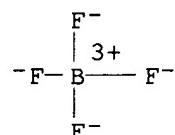
RN 12190-79-3 HCAPLUS

CN Cobalt lithium oxide (CoLiO₂) (9CI) (CA INDEX NAME)

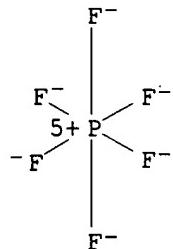
Component	Ratio	Component Registry Number
O	2	17778-80-2
Co	1	7440-48-4
Li	1	7439-93-2

RN 14283-07-9 HCAPLUS

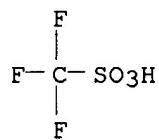
CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

Li⁺

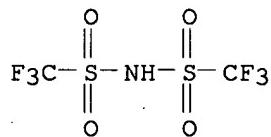
RN 21324-40-3 HCPLUS
CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



RN 33454-82-9 HCPLUS
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



RN 90076-65-6 HCPLUS
CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)

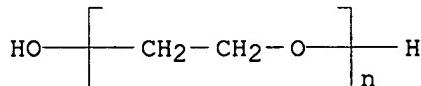


IT 7439-93-2DP, Lithium, polyethylene oxide complex 25322-68-3DP, Polyethylene glycol, lithium complex
RL: DEV (Device component use); SPN (Synthetic preparation);
PREP (Preparation); USES (Uses)
(lithium battery with polymeric electrolyte)

RN 7439-93-2 HCPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

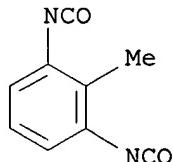
RN 25322-68-3 HCPLUS
CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



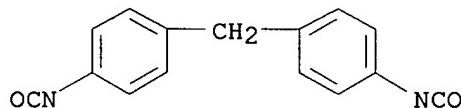
IT 91-08-7, Tolylene 2,6-diisocyanate 101-68-8,
Diphenylmethane 4,4'-diisocyanate 584-84-9, Tolylene
2,4-diisocyanate 822-06-0, Hexamethylene
diisocyanate 4098-71-9, Isophorone diisocyanate
25322-68-3D, Peo, isocyanate-terminated
25322-69-4, Polypropylene glycol
26851-39-8 64743-80-2 70198-24-2
79371-37-2 132902-95-5

RL: RCT (Reactant); RACT (Reactant or reagent)
(lithium battery with polymeric
electrolyte)

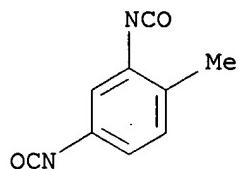
RN 91-08-7 HCPLUS
CN Benzene, 1,3-diisocyanato-2-methyl- (9CI) (CA INDEX NAME)



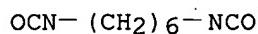
RN 101-68-8 HCPLUS
CN Benzene, 1,1'-methylenebis[4-isocyanato- (9CI) (CA INDEX NAME)



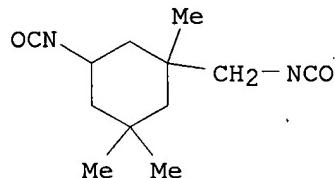
RN 584-84-9 HCPLUS
CN Benzene, 2,4-diisocyanato-1-methyl- (9CI) (CA INDEX NAME)



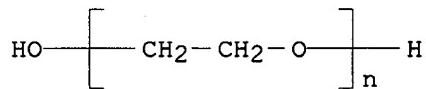
RN 822-06-0 HCPLUS
CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)



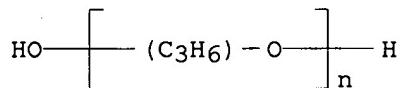
RN 4098-71-9 HCPLUS
CN Cyclohexane, 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethyl- (9CI) (CA INDEX NAME)



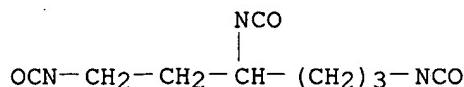
RN 25322-68-3 HCPLUS
CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



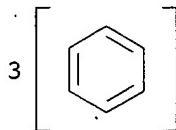
RN 25322-69-4 HCPLUS
CN Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



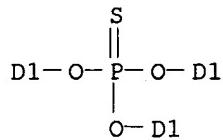
RN 26851-39-8 HCPLUS
CN Hexane, 1,3,6-triisocyanato- (9CI) (CA INDEX NAME)



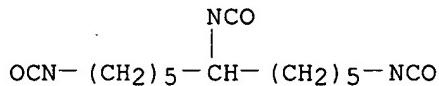
RN 64743-80-2 HCAPLUS
CN Phenol, isocyanato-, phosphorothioate (3:1) (ester) (9CI) (CA INDEX NAME)



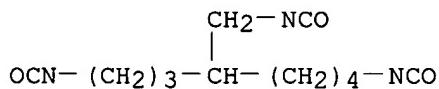
3 (D1-NCO)



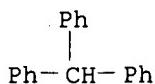
RN 70198-24-2 HCAPLUS
CN Undecane, 1,6,11-triisocyanato- (9CI) (CA INDEX NAME)



RN 79371-37-2 HCAPLUS
CN Octane, 1,8-diisocyanato-4-(isocyanatomethyl)- (9CI) (CA INDEX NAME)



RN 132902-95-5 HCAPLUS
CN Benzene, 1,1',1''-methylidynetris-, diisocyanato deriv. (9CI) (CA INDEX NAME)



2 (D1-NCO)

L21 ANSWER 8 OF 44 HCAPLUS COPYRIGHT 2003 ACS
AN 2001:752025 HCAPLUS

KATHLEEN FULLER EIC 1700/PARKER LAW 308-4290

DN 135:273652
 TI Preparations of gel **polymer** solid **electrolytes** with improved ionic conductivity and size stability
 IN Zhang, Zhengcheng; Fang, Shibi; Li, Yongjun
 PA Inst. of Chemistry, Chinese Academy of Sciences, Peop. Rep. China
 SO Faming Zhanli Shenqing Gongkai Shuomingshu, 8 pp.
 CODEN: CNXXEV
 DT Patent
 LA Chinese
 IC ICM C08L083-14
 ICS C08K005-16; C08J003-24
 CC 37-3 (Plastics Manufacture and Processing)
 Section cross-reference(s): 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	CN 1285375	A	20010228	CN 1999-111590	19990820
PRAI	CN 1999-111590		19990820		

AB The **electrolytes**, used to prep. solid **electrolyte** film with 100-300 .mu.m thickness for lithium secondary **battery**, comprise: (A) a three dimensional network having internal plasticizing **polymer** segments, (B) a Li salt, and (C) a polar small mol. plasticizer, wherein A contains polymethylsiloxane or **polyoxyalkylene**, C is selected from ethylene carbonate, propylene carbonate and butyrolactone, and B is selected from LiClO₄, LiPF₆ or LiN(CF₃SO₂)₂. The electrolytes are prep'd. by dissolving A, **crosslinking** agent contg. a **triisocyanate**, B and C in a ratio of 1:0.2:0.24-0.72:0.5-2.0 in anhyd. THF, mixing with 0.5% dibutyltin dilaurate at 75-95.degree. to obtain a viscous liq. followed by curing at 80.degree..

ST polymethylsiloxane **polyoxyalkylene** gel **polymer** solid **electrolyte** prep'n; plasticizer lithium salt **polymer** solid **electrolyte** prep'n; electrolyte film lithium secondary **battery**

IT Polysiloxanes, preparation
 RL: IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
 (**polyoxyalkylene-polyurethane-**; prepns. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)

IT Polyurethanes, preparation
 RL: IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
 (**polyoxyalkylene-siloxane-**; prepns. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)

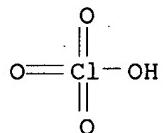
IT **Polyoxyalkylenes**, preparation
 RL: IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
 (**polyurethane-siloxane-**; prepns. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)

IT Gelation
 Plasticizers
Polymer electrolytes

Solid electrolytes**Solid state secondary batteries**

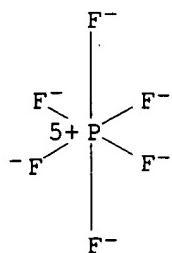
(preps. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)

- IT 7791-03-9, Lithium perchlorate (LiClO₄)
 21324-40-3, Lithium hexafluorophosphate (LiPF₆)
 90076-65-6
 RL: MOA (Modifier or additive use); USES (Uses)
 (electrolyte; preps. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)
- IT 96-48-0, gamma.-Butyrolactone 96-49-1, Ethylene carbonate 108-32-7,
 Propylene carbonate
 RL: MOA (Modifier or additive use); USES (Uses)
 (plasticizer; preps. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)
- IT 362600-41-7P
 RL: IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
 (preps. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)
- IT 7791-03-9, Lithium perchlorate (LiClO₄)
 21324-40-3, Lithium hexafluorophosphate (LiPF₆)
 90076-65-6
 RL: MOA (Modifier or additive use); USES (Uses)
 (electrolyte; preps. of gel **polymer** solid **electrolytes** with improved ionic cond. and size stability)
- RN 7791-03-9 HCPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)

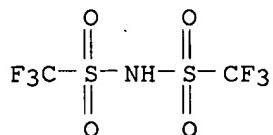


Li

- RN 21324-40-3 HCPLUS
 CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



RN 90076-65-6 HCPLUS
 CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
 lithium salt (9CI) (CA INDEX NAME)



L21 ANSWER 9 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 2001:646112 HCPLUS
 DN 135:181627
 TI Solid **polymeric electrolytes** containing network
polymers and inorganic **lithium salts** for **lithium**
 secondary **batteries** and their preparation
 IN Zhang, Zhengcheng; Fan, Shibi; Li, Yongjun
 PA Inst. of Chemistry, Chinese Academy of Sciences, Peop. Rep. China
 SO Faming Zhanli Shenqing Gongkai Shuomingshu, 8 pp.
 CODEN: CNXXEV

DT Patent
 LA Chinese
 IC ICM C08L083-14
 ICS C08L071-00; C08K003-10; H01M010-00
 CC 38-3 (Plastics Fabrication and Uses)
 Section cross-reference(s): 52, 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	CN 1280149	A	20010117	CN 1999-109568	19990709
PRAI	CN 1999-109568		19990709		

AB The **electrolyte** comprises a network **polymer** prep'd. by
crosslinking a prepolymer with a **crosslinking** agent and
 having a structure $-[\text{OSi}(\text{R1})(\text{CH}_3)]_n[\text{OSi}(\text{R2})(\text{CH}_3)]_m-$; or
 $\text{HO}(\text{CH}_2\text{CH}_2\text{O})_p\text{CH}_2\text{CH}(\text{R2})\text{CH}_2(\text{OCH}_2\text{CH}_2)_p\text{OH}$ ($m + n = 100$; $m = 10$ or 20 ; $p = 4-13$;

R1 = **polyoxyethylene/polyoxypropylene** chain segment;
R2 = an internal plasticizing chain), and an inorg. **lithium** salt
such as LiClO₄ or LiN(CF₃SO₂)₂. The presence of internal plasticizer
(such as **polyoxyethylene** allyl Me ether or **lithium**
polyoxyethylene allyl ether sulfonate) pendant on the network
backbones can lower the glass transition temps. of the electrolytes, and
accelerate the migration of free **lithium** ions migration.

ST solid **polymer electrolyte** lithium secondary
battery; polysiloxane **polyoxyalkylene**
polyurethane network **polymer electrolyte**;
ionic cond polysiloxane **polyoxyalkylene** electrolyte network

IT Polysiloxanes, uses
RL: DEV (Device component use); IMF (Industrial manufacture);
POF (Polymer in formulation); PREP (Preparation); USES (Uses)
(Me, reaction products with **polyoxyethylene** allyl Me ether,
ethylene oxide-propylene oxide copolymer and **triisocyanates**;
solid **Polymeric electrolytes** contg. network
polymers and inorg. lithium salts for lithium
secondary **batteries**)

IT Secondary batteries
(**lithium**; solid **Polymeric electrolytes**
contg. network **polymers** and inorg. lithium salts
for lithium secondary **batteries**)

IT Polysiloxanes, uses
RL: DEV (Device component use); IMF (Industrial manufacture);
POF (Polymer in formulation); PREP (Preparation); USES (Uses)
(**polyoxyalkylene-polyurethane-**; solid
Polymeric electrolytes contg. network
polymers and inorg. lithium salts for lithium
secondary **batteries**)

IT Polyurethanes, uses
RL: DEV (Device component use); IMF (Industrial manufacture);
POF (Polymer in formulation); PREP (Preparation); USES (Uses)
(**polyoxyalkylene-siloxane-**; solid **Polymeric**
electrolytes contg. network **polymers** and inorg.
lithium salts for lithium secondary **batteries**
)

IT **Polyoxyalkylenes**, uses
RL: DEV (Device component use); IMF (Industrial manufacture);
POF (Polymer in formulation); PREP (Preparation); USES (Uses)
(**Polyurethane-siloxane-**; solid **Polymeric**
electrolytes contg. network **polymers** and inorg.
lithium salts for lithium secondary **batteries**
)

IT Ionic conductivity
Polymer electrolytes
Polymer networks
Solid electrolytes
(solid **Polymeric electrolytes** contg. network
polymers and inorg. lithium salts for lithium
secondary **batteries**)

IT 9003-11-6DP, Ethylene oxide-propylene oxide copolymer, reaction products
with siloxanes and **triisocyanates** 27252-80-8DP,
Polyoxyethylene allyl methyl ether, reaction products with Me
siloxanes, ethylene oxide-propylene oxide copolymer and
triisocyanates 28805-80-3DP, reaction products with
Polyoxyalkylene-polysiloxanes 354818-56-7DP, reaction products
with Me siloxanes, ethylene oxide-propylene oxide copolymer and

triisocyanates

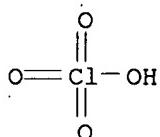
RL: DEV (Device component use); IMF (Industrial manufacture);
 POF (Polymer in formulation); PREP (Preparation); USES (Uses)
 (solid **polymeric electrolytes** contg. network
polymers and inorg. lithium salts for lithium
 secondary batteries)

IT 7791-03-9, Lithium perchlorate 90076-65-6,
 Lithium bis(trifluoromethylsulfonyl) imide
 RL: MOA (Modifier or additive use); USES (Uses)
 (solid **polymeric electrolytes** contg. network
polymers and inorg. lithium salts for lithium
 secondary batteries)

IT 7791-03-9, Lithium perchlorate 90076-65-6,
 Lithium bis(trifluoromethylsulfonyl) imide
 RL: MOA (Modifier or additive use); USES (Uses)
 (solid **polymeric electrolytes** contg. network
polymers and inorg. lithium salts for lithium
 secondary batteries)

RN 7791-03-9 HCPLUS

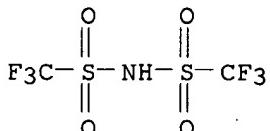
CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 90076-65-6 HCPLUS

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

L21 ANSWER 10 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 2001:98726 HCPLUS

DN 134:150055

TI **Polymer solid electrolytes** containing urethane
 (meth)acrylates and electrochemical devices, e.g. secondary
 batteries, therefrom

IN Saito, Takaitsuro; Nishimura, Takuaki

PA Nippon Synthetic Chemical Industry Co., Ltd., Japan

SO Jpn. Kokai Tokyo Koho, 9 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01B001-06
 ICS C08F290-06; H01G009-038; H01M006-18; H01M010-40
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2001035251	A2	20010209	JP 1999-205791	19990721
PRAI	JP 1999-205791		19990721		

AB The electrolyte comprises a **crosslinked polyurethane** acrylate matrix and an electrolyte salt. Electrochem. devices and secondary **batteries** comprising of the above stated electrolytes are also claimed.

ST solid **polymer electrolyte** electrochem device;
 secondary **battery electrolyte crosslinked polyurethane** acrylate; **polyoxyalkylene polyurethane** acrylate solid electrolyte; **polyethylene oxide** polyurethane acrylate solid electrolyte;
polypropylene oxide polyurethane acrylate solid electrolyte

IT **Battery electrolytes**

Polymer electrolytes
 (crosslinked polyurethane acrylates as solid electrolytes for secondary **batteries**)

IT Electric apparatus
 (electrochem., electrolytes; **crosslinked polyurethane** acrylates as solid electrolytes for secondary **batteries**)

IT **Polyurethanes, uses**
 RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
 (polyester-, acrylic; **crosslinked polyurethane** acrylates as solid electrolytes for secondary **batteries**)

IT **Polyurethanes, uses**
 RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
 (**polyoxyalkylene-**, acrylic; **crosslinked polyurethane** acrylates as solid electrolytes for secondary **batteries**)

IT 7439-93-2DP, Lithium, complexes with **crosslinked polyurethane** acrylates, uses 324018-28-2DP, lithium complex 324018-29-3DP, lithium complex 324018-30-6DP, lithium complex 324018-31-7DP, lithium complex 324018-32-8DP, lithium complex 324018-33-9DP, lithium complex 324018-34-0DP, lithium complex 324018-35-1DP, lithium complex 324018-36-2DP, lithium salt 324018-37-3DP, lithium salt
 RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (crosslinked polyurethane acrylates as solid electrolytes for secondary **batteries**)

IT 7439-93-2DP, Lithium, complexes with **crosslinked polyurethane** acrylates, uses
 RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation);

USES (Uses)

(crosslinked polyurethane acrylates as solid
electrolytes for secondary batteries)

RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 11 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2000:810251 HCAPLUS
 DN 134:281350
 TI Electrochemical characterization of **polymer electrolytes**
 based on polyether/hydroxyethylcellulose
 AU Regiani, Anelise M.; Pawlicka, Agnieszka; Curvelo, A. Aprigio S.; Gandini,
 Alessandro; LeNest, Jean-Francois
 CS Instituto de Quimica de Sao Carlos - USP; Av. Dr. Carlos Botelho, Sao
 Carlos, 13560970, Brazil
 SO Natural Polymers and Composites, [Proceedings from the Third International
 Symposium on Natural Polymers and Composites, [and the] Workshop on
 Progress in Production and Processing of Cellulosic Fibres and Natural
 Polymers], Sao Pedro, Brazil, May 14-17, 2000 (2000), 146-150. Editor(s):
 Capparelli Mattoso, Luiz Henrique; Leao, Alcides; Frollini, Elisabete.
 Publisher: Embrapa Instrumentacao Agropecuaria, Sao Carlos, Brazil.
 CODEN: 69AHKY
 DT Conference
 LA English
 CC 36-5 (Physical Properties of Synthetic High Polymers)
 Section cross-reference(s): 43, 76
 AB The ionic cond. of various solid electrolytes based on
 hydroxyethylcellulose (HEC) grafted or **crosslinked** with
 oligoether **diisocyanates** was investigated. The mechanism ruling
 the ionic conduction followed a free-vol. theory represented by the
 William Landel Ferry (WLF) model, typical for amorphous electrolytes. The
 cond. in these films is independent of the HEC structural parameters. The
 actual values of cond. measured at ambient temp. suggest that the
 electrolytes described here could be used as an alternative to the
 corresponding networks based on poly(ethylene oxide) alone.
 ST hydroxyethylcellulose polyether electrolyte ionic cond
 IT **Polyoxalkylenes**, properties
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic
 preparation); PREP (Preparation); USES (Uses)
 (diisocyanate derives., polymers with
 hydroxyethylcellulose, LiClO₄-doped; electrochem. characterization of
 polymer electrolytes based on
 polyether/hydroxyethylcellulose)
 IT Glass transition temperature
 Ionic conductivity
 Polyelectrolytes
 (electrochem. characterization of **polymer**
electrolytes based on polyether/hydroxyethylcellulose)
 IT **Polyurethanes**, properties
 RL: PRP (Properties); SPN (Synthetic preparation); PREP
 (Preparation)
 (polyoxalkylene-; electrochem. characterization of
 polymer electrolytes based on

polyether/hydroxyethylcellulose)

IT 9004-62-0DP, Cellosize QP 09H, polymers with poly(ethylene oxide) diisocyanate derivs. 25322-68-3DP,
Polyethylene oxide, diisocyanate derivs., polymers with hydroxyethylcellulose
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
 (LiClO₄-doped; electrochem. characterization of polymer electrolytes based on polyether/hydroxyethylcellulose)

IT 7791-03-9, Lithium perchlorate
 RL: MOA (Modifier or additive use); USES (Uses)
 (dopant; electrochem. characterization of polymer electrolytes based on polyether/hydroxyethylcellulose)

RE.CNT 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD

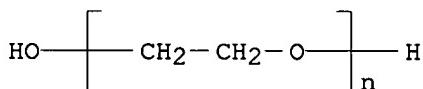
RE

- (1) LeNest, J; British Polymer Journal 1988, V20, P253 HCPLUS
- (2) LeNest, J; Electrochimica Acta 1992, V37(i.9), P1585
- (3) LeNest, J; Polymer Bulletin 1991, V25, P443
- (4) Le Nest, J; Trip 1994, V2(i.12), P432
- (5) Regiani, A; Polimeros: Ciencia e tecnologia 1999, V9, P45 HCPLUS
- (6) Regiani, A; to be published in Polymer international
- (7) Schoenenberger, C; Electrochimica acta 1995, V40(i.13-14), P2281
- (8) Velasquez-Morales, P; Electrochimica Acta 1998, V43(i.10-11), P1275

IT 25322-68-3DP, **Polyethylene oxide, diisocyanate derivs., polymers with hydroxyethylcellulose**
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
 (LiClO₄-doped; electrochem. characterization of polymer electrolytes based on polyether/hydroxyethylcellulose)

RN 25322-68-3 HCPLUS

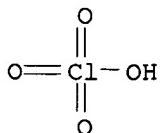
CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



IT 7791-03-9, Lithium perchlorate
 RL: MOA (Modifier or additive use); USES (Uses)
 (dopant; electrochem. characterization of polymer electrolytes based on polyether/hydroxyethylcellulose)

RN 7791-03-9 HCPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 12 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2000:688306 HCAPLUS
 DN 133:282489
 TI Compositions of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and their use in secondary batteries
 IN Hata, Kimiko; Sato, Takaya
 PA Nissinbo Industries, Inc., Japan
 SO PCT Int. Appl., 59 pp.
 CODEN: PIXXD2
 DT Patent
 LA Japanese
 IC ICM C08L029-04
 ICS C08F008-00; C08K003-00; H01B001-06; H01M010-40; H01M004-62;
 H01M004-04
 CC 37-3 (Plastics Manufacture and Processing)
 Section cross-reference(s): 52
 FAN.CNT 3

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2000056815	A1	20000928	WO 2000-JP1734	20000322
	W: CA, CN, JP, KR, SG, US				
	RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
	CA 2333277	AA	20000928	CA 2000-2333277	20000322
	EP 1090956	A1	20010411	EP 2000-911270	20000322
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, FI				
	US 6537468	B1	20030325	US 2000-700912	20001121
PRAI	JP 1999-78087	A	19990323		
	WO 2000-JP1734	W	20000322		
AB	The compns. contain (A) polymers having high cond., adhesive strength and shape retention property, (B) ionically conductive salts and (C) crosslinkable compds. and are used as solid polyelectrolytes and binders for secondary batteries where the polymers are polyvinyl alc. type compds. which bear oxyalkylene groups. Thus, mixing a soln. of a poly(vinyl alc.) (Mw 500, sapon. degree >98%) 10 in acetone 70 with a soln. of NaOH 1.81 in water 2.5 at room temp. for 1 h, combining the resulting mixt. with a soln. of glycidol 67 in acetone 100 parts over 3 h, stirring for 8 h at 50.degree. and working up gave a dihydroxypropylated poly(vinyl alc.) with substitution degree of 0.74, which was cyanoethylated with acrylonitrile to give a polymer deriv. (A). Dissolving the A with Li perchlorate (I) in THF, evapg. the solvent, mixing 1 part the resulting composite with 0.2 parts polyethylene glycol dimethacrylate and 0.2 parts methoxypolyethylene glycol monomethacrylate and AIBN so that a conductive solid polymer compn. with adjusted I content of 1 mol/kg-compn. could be reached, and heating the compn. between 2 Cu panels at 100.degree. for 1 h gave a 200-.mu.m film with elec. cond. 4.2x10 ⁻⁴ S/cm, adhesive strength 0.8 kN/m, amorphous polymer phase, solid state at room temp. and wt. loss <0.15%.				
ST	secondary battery solid polyelectrolyte polyvinyl alc dihydroxypropylated deriv compn; polyethylene glycol dimethacrylate crosslinker polymer electrolyte				
IT	Binders Electrolytes				

Solid state secondary batteries

(compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT Polymer blends

RL: POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)

(semi-interpenetrating network; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT Polyurethanes, preparation

RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(semi-interpenetrating networks with poly(vinyl alc.) derivs.; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 54140-67-9, Denacol EX 145

RL: MOA (Modifier or additive use); USES (Uses)

(branching agent; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 9003-20-7DP, Poly(vinyl acetate), partially saponified, oxyalkylated, reaction products with acrylonitrile 25067-34-9DP, Ethylene-vinyl alcohol copolymer, oxyalkylated, reaction products with acrylonitrile

RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 107-13-1, Acrylonitrile, uses

RL: MOA (Modifier or additive use); USES (Uses)

(cyanoethylation agent; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 556-52-5, Glycidol

RL: MOA (Modifier or additive use); USES (Uses)

(dihydroxypropylation agent; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 7791-03-9, Lithium perchlorate

RL: TEM (Technical or engineered material use); USES (Uses)

(electrolytes; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 75-56-9, Propylene oxide, uses

RL: MOA (Modifier or additive use); USES (Uses)

(hydroxypropylation agent; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 9002-89-5DP, Poly(vinyl alcohol), oxyalkylated, reaction products with acrylonitrile

RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(semi-interpenetrating networks with crosslinked polymers;

compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

IT 31694-55-0DP, Polyethylene glycol glycerol ether, polyurethanes 108927-94-2P, Methoxypolyethylene glycol monomethacrylate-polyethylene glycol dimethacrylate copolymer
 RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (semi-interpenetrating networks with poly(vinyl alc.) derivs.; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

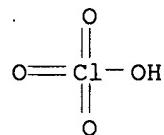
- (1) Kabushiki Kaisha Fujikura; JP 200090731 A 2000
- (2) Mitsubishi Cable Industries Ltd; JP 06140051 A 1994 HCPLUS
- (3) Mitsubishi Cable Industries Ltd; JP 06150941 A 1994 HCPLUS
- (4) Nippon Oil Company Ltd; JP 08273653 A 1996 HCPLUS
- (5) Ricoh Company Ltd; JP 1167215 A 1999
- (6) Ricoh Company Ltd; JP 1167216 A 1999
- (7) Shin-Etsu Chemical Co Ltd; JP 04363869 A 1992 HCPLUS
- (8) Yuasa Battery Comp Any Limited; JP 287482 A
- (9) Yuasa Battery Comp Any Limited; EP 360508 A 1990 HCPLUS

IT 7791-03-9, Lithium perchlorate

RL: TEM (Technical or engineered material use); USES (Uses)
 (electrolytes; compns. of ionically conductive solid polymers, ionically conductive solid polyelectrolytes, binder resins and use in secondary batteries)

RN 7791-03-9 HCPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 13 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 2000:520356 HCPLUS

DN 133:208603

TI Ionic conductivity and physical stability study of gel network polymer electrolytes

AU Zhang, Zhengcheng; Fang, Shibi

CS Institute of Chemistry, Chinese Academy of Sciences, Beijing, 100080, Peop. Rep. China

SO Journal of Applied Polymer Science (2000) 77(13), 2957-2962
 CODEN: JAPNAB; ISSN: 0021-8995

PB John Wiley & Sons, Inc.

DT Journal

LA English
CC 37-5 (Plastics Manufacture and Processing)
Section cross-reference(s): 76
AB Gel polymer electrolytes (GPE) were prep'd. by crosslinking between poly(ethylene glycol) and a crosslinking agent with three isocyanate groups in the presence of propylene carbonate (PC) and ethylene carbonate (EC) or their mixt., and their ionic cond. was measured. When the plasticizer amt. was fixed, the ionic cond. was greatly influenced by the nature of plasticizer. The cond. data followed the Arrhenius equation. Whatever plasticizer was used, max. ambient cond. was found at a salt concn. ratio [Li⁺]/[EO] equal to 0.20. The phys. stability of the GPEs was studied qual. by wt. loss under pressure. The stability was greatly affected by the network structure and the most stable was the GPE contg. the PEO1000 segment, which has a strong interaction between network and plasticizer.
ST polyethylene glycol isocyanate
crosslinking electrolyte gel prep'n; plasticizer PEO gel
electrolyte cond network structure
IT Crosslinking
Gels
Ionic conductivity
Plasticizers
 Polymer electrolytes
 Polymer networks
 (effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
IT Polyurethanes, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (polyether-; effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
IT 7791-03-9, Lithium perchlorate
RL: PRP (Properties)
 (effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
IT 7439-93-2DP, Lithium, PEO-trimethylolpropane-TDI polyurethane complexes, preparation 88842-46-0DP, lithium complexes .
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
IT 77-99-6, 1,1,1-Tri(hydroxymethyl)propane 584-84-9, Toluene-2,4-diisocyanate
RL: RCT (Reactant); RACT (Reactant or reagent)
 (effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
IT 68-12-2, DMF, uses 96-48-0, gamma.-Butyrolactone 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 513-85-9, Dimethyl ethylene glycol 24471-99-6, Diethylene orthocarbonate
RL: MOA (Modifier or additive use); USES (Uses)
 (plasticizer; effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)
RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD

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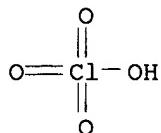
IT 7791-03-9, Lithium perchlorate

RL: PRP (Properties)

(effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)

RN 7791-03-9 HCPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

IT 7439-93-2DP, Lithium, PEO-trimethylolpropane-TDI

polyurethane complexes, preparation

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)

RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IT 584-84-9, Toluene-2,4-diisocyanate

RL: RCT (Reactant); RACT (Reactant or reagent)

(effect of plasticizer on ionic cond. and stability of PEO-based polyurethane/lithium perchlorate gel electrolytes)

RN 584-84-9 HCPLUS

CN Benzene, 2,4-diisocyanato-1-methyl- (9CI) (CA INDEX NAME)



L21 ANSWER 14 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 2000:520275 HCAPLUS
 DN 133:223128
 TI **Polymer electrolytes based on lithium sulfonate derived from perfluorovinyl ethers; single ion conductors**
 AU Bayoudh, Sami; Parizel, Nathalie; Reibel, Leonard
 CS CNRS Institut Charles Sadron, Strasbourg, 67083, Fr.
 SO Polymer International (2000), 49(7), 703-711
 CODEN: PLYIEI; ISSN: 0959-8103
 PB John Wiley & Sons Ltd.
 DT Journal
 LA English
 CC 35-7 (Chemistry of Synthetic High Polymers)
 Section cross-reference(s): 36, 76
 AB A **lithium** perfluoroalkyl sulfonate was synthesized from a com. perfluorovinyl ether fitted with a fluorosulfonyl group. By making use of the vinylether group, this species was incorporated into **polyurethane** networks based either on a poly(ethylene oxide) glycol or on a tri-arm star poly(ethylene oxide) triol. The ionic cond., thermal properties, and morphol. domains of rigidity (solid-state ¹H NMR), were measured for the single cation conductor **polymer electrolytes**. When compared to the **polymer electrolytes** where the same but untethered **lithium** perfluoroalkyl sulfonate is dissolved in the same initial networks, a loss of cond. was obsd. despite the higher mobility of the ionomers. This loss corresponds to the cond. attributed to the anionic species. The higher mobility of the ionemic electrolytes is to be related to the quasi absence of phys. **crosslinks**.
 ST **lithium** perfluoroalkylsulfonate vinylether **polyurethane** network prepn cond; **polyethylene oxide** based **polyurethane** electrolyte **lithium** fluoroalkylsulfonate; ionic cond morphol **lithium** fluoroalkylsulfonate **polyurethane** network
 IT **Polyurethanes, preparation**
Polyurethanes, preparation
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (polyether-, fluorine-contg.; prepn. and morphol. and single ion cond. of **lithium** sulfonate perfluorovinyl ether
polyurethane electrolyte networks based on linear and star poly(ethylene oxide)s)
 IT **Fluoropolymers, preparation**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (polyether-**polyurethane-**; prepn. and morphol. and single ion cond. of **lithium** sulfonate perfluorovinyl ether
polyurethane electrolyte networks based on linear and star poly(ethylene oxide)s)
 IT **Polyethers, preparation**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (**polyurethane-**, fluorine-contg.; prepn. and morphol. and single ion cond. of **lithium** sulfonate perfluorovinyl ether
polyurethane electrolyte networks based on linear and star poly(ethylene oxide)s)
 IT **Glass transition temperature**
Ionic conductivity

- Polymer electrolytes**
 - Polymer morphology**
 - Polymer networks**
 - (prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT Ionomers
 - RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 - (prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT 214690-38-7P, Lithium perfluoro-3,6-dioxa-4-methyl-.DELTA.7-octylsulfonate
 - RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)
 - (intermediate; prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT 291276-47-6P
 - RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)
 - (monomer; prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT 291276-48-7P 291276-50-1P 291276-52-3P 291276-53-4P 291276-54-5P
291276-55-6P
 - RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)
 - (prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT 291276-49-8P 291276-51-2DP, lithium salts
 - RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 - (prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
 - IT 60-24-2, Mercaptoethanol 1310-65-2, Lithium hydroxide
16090-14-5, Perfluoro-3,6-dioxa-4-methyl-.DELTA.7-octylsulfonyl fluoride
50586-59-9, Trimethylolpropane **polyethylene glycol** ether
 - RL: RCT (Reactant); RACT (Reactant or reagent)
 - (prepn. and morphol. and single ion cond. of lithium sulfonate perfluorovinyl ether **polyurethane** electrolyte networks based on linear and star poly(ethylene oxide)s)
- RE.CNT 33 THERE ARE 33 CITED REFERENCES AVAILABLE FOR THIS RECORD
- RE
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L21 ANSWER 15 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1999:805535 HCPLUS
 DN 132:139705
 TI Synthesis and characterization of polyether **urethane** acrylate-LiCF₃SO₃-based **polymer electrolytes** by UV-curing in **lithium batteries**
 AU Kim, C.-S.; Kim, B.-H.; Kim, K.
 CS Sungbuk-ku, 1 Anam-dong, Department of Chemistry, Korea University, Seoul, S. Korea
 SO Journal of Power Sources (1999), 84(1), 12-23
 CODEN: JPSODZ; ISSN: 0378-7753
 PB Elsevier Science S.A.
 DT Journal
 LA English
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 36, 38
 AB The prepolymers of polyether **urethane** acrylate (PEUA) were synthesized from polyether polyol (**Polyethylene glycol** (PEG) or **polypropylene glycol** (PPG)), **diisocyanate** (hexamethylene **diisocyanate** (HMDI) or toluene 2,4-**diisocyanate** (TDI)), and the caprolactone-modified hydroxyethyl acrylate (FA2D) using the catalyst (dibutyltin dilaurate (DBTDL)) by stepwise addn. reaction. LiCF₃SO₃ was dissolved in PEUA prepolymers, and plasticizer (propylene carbonate (PC)) was added into prepolymer and salt mixts. Then photoinitiator (Irgacure 184) was also dissolved in the mixts. Thin films were prep'd. by casting on the glass plate, and then by curing the plasticized prepolymer and salt mixts.. under UV radiation. Electrochem. and elec. properties of PEUA-LiCF₃SO₃-based

- polymer electrolytes were evaluated and discussed to be used in lithium batteries.
- ST lithium battery polymer electrolyte ; polyether urethane acrylate lithium triflate electrolyte
- IT Transference number (lithium; synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT Crosslinking (photochem.; synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT Polyurethanes, uses
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(polyether-; synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT Battery electrolytes
Ionic conductivity
Polymer electrolytes (synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT Oligomers
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT 947-19-3, Irgacure 184
RL: TEM (Technical or engineered material use); USES (Uses)
(photoinitiator; synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT 108-32-7, Propylene carbonate
RL: TEM (Technical or engineered material use); USES (Uses)
(plasticizer; synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries).
- IT 77-58-7, Dibutyltin dilaurate
RL: CAT (Catalyst use); USES (Uses)
(synthesis and characterization of polyether urethane acrylate-LiCF₃SO₃-based polymer electrolytes by UV-curing in lithium batteries)
- IT 33454-82-9DP, Lithium triflate, prepolymer complexes 256473-40-2DP, lithium triflate-doped 256473-40-2P, Polyethylene glycol-hexamethylene diisocyanate -caprolactone-modified hydroxyethyl acrylate copolymer 256473-41-3P 256473-42-4DP, lithium triflate-doped 256473-43-5P 256473-44-6DP, lithium triflate-doped
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic

preparation); PREP (Preparation); USES (Uses)
(synthesis and characterization of polyether urethane
acrylate-LiCF₃SO₃-based polymer electrolytes by
UV-curing in lithium batteries)

IT 7439-93-2, Lithium, properties

RL: PRP (Properties)

(transference no.; synthesis and characterization of polyether
urethane acrylate-LiCF₃SO₃-based polymer
electrolytes by UV-curing in lithium
batteries)

RE.CNT 19 THERE ARE 19 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

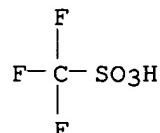
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IT 33454-82-9DP, Lithium triflate, prepolymer complexes

RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(synthesis and characterization of polyether urethane
acrylate-LiCF₃SO₃-based polymer electrolytes by
UV-curing in lithium batteries)

RN 33454-82-9 HCPLUS

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



④ Li

IT 7439-93-2, Lithium, properties

RL: PRP (Properties)

(transference no.; synthesis and characterization of polyether
urethane acrylate-LiCF₃SO₃-based polymer
electrolytes by UV-curing in lithium

batteries)
RN 7439-93-2 HCPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 16 OF 44 HCPLUS COPYRIGHT 2003 ACS
AN 1999:663411 HCPLUS
DN 131:260005
TI Solid electrolyte **batteries** and their manufacture
IN Kato, Ikuo; Kahata, Toshiyuki; Taniuchi, Masahiro; Fujii, Toshishige
PA Ricoh Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 13 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM H01M010-40
ICS H01M004-04; H01M004-62; H01M006-18; H01M006-22
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 11288738	A2	19991019	JP 1998-105514	19980401
PRAI	JP 1998-105514		19980401		
AB	The batteries have a cathode contg. a crosslinked solid electrolyte at least on the surface of its active mass layer, an anode contg. a crosslinked solid electrolyte at least on the surface of its active mass layer facing the electrolyte layer on the cathode surface, and a crosslinked binder solid electrolyte layer between the electrodes. The batteries are prep'd. by forming the solid electrolyte layers on a cathode and an anode, applying a soln. of a polymer or a polymerizable compd. on the electrolyte layer on the cathode and/or anode, stacking the electrodes with the electrolyte layers facing each other, and gelling the soln. to form the binder electrolyte .				
ST	solid electrolyte battery structure manuf				
IT	Polyurethanes , uses RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses) (electrolyte compns. for coating electrodes in solid electrolyte lithium batteries contg. binder electrolyte layer)				
IT	Secondary batteries (lithium; manuf. of lithium batteries contg. binder electrolyte layer between solid electrolyte coated electrodes)				
IT	9011-14-7, Polymethyl methacrylate 9011-17-0, Hexafluoropropylene-vinylidene fluoride copolymer 25014-41-9, Polyacrylonitrile RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses) (binder electrolyte compns. for secondary lithium batteries contg. solid electrolyte coated electrodes)				
IT	9059-74-9D, Hexamethylene diisocyanate-polyethylene glycol copolymer, crosslinked 26570-48-9D, Polyoxyethylene diacrylate, crosslinked 52271-32-6D, Methyl methacrylate-trimethylolpropane triacrylate copolymer,				

crosslinked

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(electrolyte compns. for coating electrodes in solid electrolyte
lithium batteries contg. binder electrolyte layer)

IT 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 616-38-6,

Dimethyl carbonate **90076-65-6**

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(electrolyte compns. for **lithium batteries** contg.

binder electrolyte layer between solid electrolyte coated electrodes)

IT **90076-65-6**

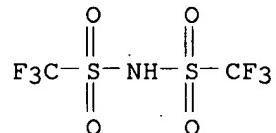
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(electrolyte compns. for **lithium batteries** contg.

binder electrolyte layer between solid electrolyte coated electrodes)

RN 90076-65-6 HCPLUS

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

L21 ANSWER 17 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 1998:682846 HCPLUS

DN 129:316987

TI Composition effects in polyether **urethane**-based solid **polymer electrolytes**

AU Ng, Simon T. C.; Forsyth, Maria; MacFarland, Douglas R.; Garcia, Maria; Smith, Mark E.; Strange, John H.

CS Department of Materials Engineering, Monash Univ., Victoria, 3168, Australia

SO Polymer (1998), 39(25), 6261-6268

CODEN: POLMAG; ISSN: 0032-3861

PB Elsevier Science Ltd.

DT Journal

LA English

CC 37-5 (Plastics Manufacture and Processing)

Section cross-reference(s): 38, 72

AB NMR spectroscopy (n.m.r.), dynamic mech. thermal anal. (d.m.t.a.) and AC impedance techniques have been used in combination to probe the effect of **electrolyte** compn. in an archetypal solid **polymer** **electrolyte** compn. in an archetypal solid **polymer** **electrolyte** (SPE). A series of solid **polymer** **electrolytes** (SPEs) based on a **urethane**-**crosslinked** trifunctional poly(ethylene glycol) **polymer** host contg. dissolved ionic species (LiClO_4 and LiCF_3SO_3) have been studied. D.m.t.a. has established that increasing LiClO_4 concn. causes a

decrease in the polymer segmental mobility, owing to the formation of transient **crosslinks** via cation-polymer interaction. Investigation of the distribution of mech./structural relaxation times for the LiClO₄/polymer complex with d.m.t.a. reveals that increasing LiClO₄ concn. causes a slight broadening of the distribution, indicating a more heterogeneous environment. Results of n.m.r. ⁷Li T₁ and T₂ relaxation expts. support the idea that higher salt concns. encourage ionic aggregation. This is of crit. importance in detg. the cond. of the material since it affects the no. of charge carriers available. Introduction of the plasticizer tetraglyme into the LiClO₄-based SPEs suppresses the glass transition temp. of the SPE, and causes a significant broadening of the relaxation time distribution (as measured by d.m.t.a.).

- ST **polyoxyalkylene polyurethane** solid electrolyte elec cond; viscoelasticity **polyoxyalkylene polyurethane** lithium complex electrolyte; tetraglyme plasticizer polyether **polyurethane** solid electrolyte; HMDI **crosslinked** oxirane methyloxirane copolymer electrolyte
- IT **Battery electrolytes**
Glass transition
Ionic conductivity
Magnetic relaxation
Viscoelasticity
(compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- IT **Polyurethanes, properties**
RL: POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**polyoxyalkylene**-; compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- IT Plasticizers
(tetraglyme; compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- IT 822-06-0D, HMDI, **polymers** with trifunctional ethylene oxide-propylene oxide glycol, Li complexes 7439-93-2D, Lithium, complexes with HMDI-**crosslinked** trifunctional ethylene oxide-propylene oxide glycol, properties 9003-11-6D, Ethylene oxide-propylene oxide copolymer, trifunctional glycol deriv., HMDI-**crosslinked**, Li complexes
RL: POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- IT 7791-03-9, Lithium perchlorate 33454-82-9,
Lithium triflate
RL: RCT (Reactant); RACT (Reactant or reagent)
(compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- IT 143-24-8, Tetraglyme
RL: MOA (Modifier or additive use); USES (Uses)
(plasticizer; compr. effects in polyether-**urethane**-based solid **polymer electrolytes**)
- RE.CNT 44 THERE ARE 44 CITED REFERENCES AVAILABLE FOR THIS RECORD
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IT 822-06-0D, HMDI, **polymers** with trifunctional ethylene oxide-propylene oxide glycol, Li complexes 7439-93-2D, Lithium, complexes with HMDI-crosslinked trifunctional ethylene oxide-propylene oxide glycol, properties
RL: POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(compr. effects in polyether-**urethane**-based solid polymer electrolytes)

RN 822-06-0 HCAPLUS

CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

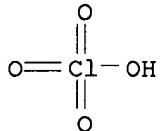
OCN-(CH₂)₆-NCO

RN 7439-93-2 HCAPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

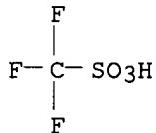
Li

IT 7791-03-9, Lithium perchlorate 33454-82-9,
Lithium triflate
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (compn. effects in polyether-**urethane**-based solid
polymer electrolytes)
 RN 7791-03-9 HCPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 33454-82-9 HCPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)

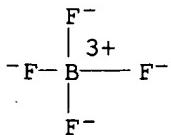


Li

L21 ANSWER 18 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1998:504885 HCPLUS
 DN 129:203401
 TI Active ray-**polymerizable** compositions and their use in solid
electrolytes
 IN Takeuchi, Masataka; Yabe, Masaji; Okubo, Takashi
 PA Showa Denko K. K., Japan
 SO Jpn. Kokai Tokkyo Koho, 16 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM C08F002-50
 ICS C08F004-00; C08F020-22; C08F020-26; C08F020-58; C08F299-00;
 C08G061-02; H01B001-12; H01G009-025; H01M010-40
 CC 35-4 (Chemistry of Synthetic High Polymers)
 Section cross-reference(s): 52
 FAN.CNT 1

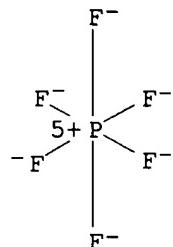
PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 10204109	A2	19980804	JP 1997-8844	19970121
PRAI JP 1996-313807		19961125		
OS MARPAT 129:203401				
AB	The compns. with good film coatability and high ion cond. and capacity, esp. useful for primary and secondary batteries and capacitors, are obtained from (A) active ray- polymerizable compds. having functional groups which can form crosslinked or/and pendant-contg. polymers , (B) electrolytes and (C) polymn. initiators XCOY (X = optionally substituted aryl groups; Y = substituted phosphinoyl groups). Mixing a triurethane compd. derived from a propylene oxide adduct of glycerol and 2- isocyanatoethyl methacrylate, 1.0, with di-Et carbonate 1.5, ethylene carbonate 1.5, LiBF ₄ 0.30 and Lucirin TPO (photoinitiator) 0.004 g, coating the resulting mixt. on a PET polyester film, and irradiating with chem. fluorescent light for 10 min gave a film contg. electrolyte.			
ST	electrolyte solid film forming polymer compn; ion cond solid electrolyte graft polymer ; photochem polymn methacrylate polyoxyalkylene electrolyte ; photoinitiator phosphine oxide polymn polyoxyalkylene methacrylate			
IT	Capacitors (double layer; manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	Polyoxyalkylenes , preparation RL: IMF (Industrial manufacture) ; PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation) ; USES (Uses) (fluorine-contg., acrylic urethane adducts, polymers ; manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	Primary batteries Secondary batteries Solid electrolytes (manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	Polyoxyalkylenes , preparation RL: IMF (Industrial manufacture) ; PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation) ; USES (Uses) (perfluoro, acrylic urethane adducts, polymers ; manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	Polymerization catalysts (photopolymn., phosphine oxide compds.; manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	Fluoropolymers, preparation Fluoropolymers, preparation RL: IMF (Industrial manufacture) ; PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation) ; USES (Uses) (polyoxyalkylene -, acrylic urethane adducts, polymers ; manuf. of active ray- polymerizable compns. and use in solid electrolytes)			
IT	14283-07-9 RL: TEM (Technical or engineered material use); USES (Uses) (electrolytes ; manuf. of active ray- polymerizable			

- compns. and use in solid **electrolytes**)
- IT 145052-34-2, Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentyl phosphine oxide
 RL: CAT (Catalyst use); USES (Uses)
 (manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 202739-68-2P 202739-72-8P 212143-10-7P 212190-46-0DP, graft polymer with perfluoro polyoxymethylenepolyoxyethylene acrylic urethane deriv.
 RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 429-06-1, Tetraethylammonium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate (LiPF₆)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 76287-91-7P 87260-75-1P
 RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
 (monomer; reaction in manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 189146-15-4, Lucirin TPO
 RL: CAT (Catalyst use); USES (Uses)
 (photoinitiator; manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 375-01-9P, 2,2,3,3,4,4,4-Heptafluoro-1-butanol
 RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
 (reaction in manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 25791-96-2, Propylene oxide polymer glyceryl ether 30674-80-7, 2-Isocyanatoethyl methacrylate 37286-64-9, Polypropylene glycol monomethyl ether 107852-51-7, Fomblin Z-DOL
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (reaction in manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- IT 14283-07-9
 RL: TEM (Technical or engineered material use); USES (Uses)
 (electrolytes; manuf. of active ray-polymerizable compns. and use in solid **electrolytes**)
- RN 14283-07-9. HCAPLUS
- CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



● Li⁺

IT 21324-40-3, Lithium hexafluorophosphate (LiPF₆)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (manuf. of active ray-polymerizable compns. and use in solid
 electrolytes)
 RN 21324-40-3 HCAPLUS
 CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



L21 ANSWER 19 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1998:433676 HCAPLUS
 DN 129:189826
 TI Polymer solid electrolytes from poly(oxyethylene) derivatives
 AU Kohjiya, Shinzo; Ikeda, Yuko
 CS Institute for Chemical Research, Kyoto University, Kyoto, 611-0011, Japan
 SO Materials Science Research International (1998), 4(2), 73-78
 CODEN: MSRIFY; ISSN: 1341-1683
 PB Society of Materials Science, Japan
 DT Journal; General Review
 LA English
 CC 36-0 (Physical Properties of Synthetic High Polymers)
 AB A review with 13 refs. Mol. design of the polymer solid electrolyte based on rubbery state of polymer is presented. Biocompatible segmented polyurethane elastomers with poly(oxyethylene)-poly(oxytetramethylene)-poly(oxyethylene) segments were used at first for the matrix of solid electrolyte. Next, oligomeric poly(oxyethylene) (PEO) chains were grafted to polysiloxane main chain to give a rubbery matrix for ion conduction when doped with LiClO₄. The latter showed higher conductivities than the former. However, the mech. properties of the latter were poor, and its crosslinking resulted in the lower cond. Copolymer prep'd. from ethylene oxide and epichlorohydrin was evaluated as a solid electrolyte. The epichlorohydrin units did not contribute to the ion conduction resulting in relatively low conductivities, though it was good in term of mech. properties. The final mol. design of the ion conductive matrix was the high mol. wt. comb-shaped PEO with oxyethylene segments as side chains. Both main and side chains are oxyethylene units and the mol. wt. was in the order of 106. The side oxyethylene units discouraged crystn. of PEO. Excellent conductivities were obsd. on doping with Li salts.
 ST review solid electrolyte polyoxyethylene lithium salt
 IT Ionic conductivity

- Polymer electrolytes**
(design and prepn. of **polymer** solid **electrolytes**
from poly(oxyethylene) derivs. and **lithium** compds.)
- IT Simulation and Modeling, physicochemical
(mol. design; design and prepn. of **polymer** solid
electrolytes from poly(oxyethylene) derivs. and **lithium**
compds.)
- IT Urethane rubber, processes
RL: PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; **PROC (Process)**
(**polyoxyalkylene**-, block, **lithium** complexes; design
and prepn. of **polymer** solid **electrolytes** from
poly(oxyethylene) derivs. and **lithium** compds.)
- IT Silicone rubber, processes
Silicone rubber, processes
RL: PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; **PROC (Process)**
(**polyoxyalkylene**-, graft, **lithium** complexes; design
and prepn. of **polymer** solid **electrolytes** from
poly(oxyethylene) derivs. and **lithium** compds.)
- IT Urethane rubber, processes
RL: PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; **PROC (Process)**
(**polyoxyalkylene**-polyurea-, block, **lithium**
complexes; design and prepn. of **polymer** solid
electrolytes from poly(oxyethylene) derivs. and **lithium**
compds.)
- IT Synthetic rubber, processes
Synthetic rubber, processes
RL: PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; **PROC (Process)**
(**polyoxyalkylene**-siloxane, graft, **lithium**
complexes; design and prepn. of **polymer** solid
electrolytes from poly(oxyethylene) derivs. and **lithium**
compds.)
- IT 115401-75-7DP, **lithium** complexes
RL: PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; **PROC (Process)**
(comb-shaped, rubber; design and prepn. of **polymer** solid
electrolytes from poly(oxyethylene) derivs. and **lithium**
compds.)
- IT 7439-93-2D, **Lithium**, **polyoxyethylene** side
chain-contg. **polymer** complexes, processes
RL: PEP (Physical, engineering or chemical process); **PROC (Process)**
(design and prepn. of **polymer** solid **electrolytes**
from poly(oxyethylene) derivs. and **lithium** compds.)
- IT 108006-87-7DP, 1,2-Ethylenediamine-MDI-**polyoxyethylene**
-**polyoxtetramethylene** block copolymer, **lithium** complexes
118722-26-2DP, Ethylene glycol-MDI-**polyoxyethylene**
-**polyoxtetramethylene** block copolymer, **lithium** complexes
211676-89-0DP, Dimethylsilanediol-methylsilanediol-**polyoxyethylene**
acrylate methyl ether graft copolymer, **lithium** complexes
211676-90-3DP, Methylsilanediol-**polyoxyethylene** diacrylate graft
copolymer, **lithium** complexes
RL: PEP (Physical, engineering or chemical process); **PRP (Properties)**;
SPN (Synthetic preparation); **PREP (Preparation)**; **PROC (Process)**
(rubber; design and prepn. of **polymer** solid

electrolytes from poly(oxyethylene) derivs. and lithium compds.)

IT 154429-82-ODP, lithium complexes

RL: PEP (Physical, engineering or chemical process); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)
(rubber; design and prepn. of polymer solid
electrolytes from poly(oxyethylene) derivs. and lithium compds.)

RE.CNT 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

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- (12) Nishimoto, A; Electrochim Acta, in press
- (13) Wada, Y; Polym Prep Japan 1997, V46, P507

IT 7439-93-2D, Lithium, polyoxyethylene side chain-contg. polymer complexes, processes

RL: PEP (Physical, engineering or chemical process); PROC (Process)
(design and prepn. of polymer solid **electrolytes**
from poly(oxyethylene) derivs. and lithium compds.)

RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 20 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 1998:275021 HCPLUS

DN 129:35350

TI Acrylic (fluoro)**polyoxyalkylene** solid electrolytes for compounding with electrodes useful in batteries and double-layer capacitors and manufacturing thereof

IN Takeuchi, Masataka; Yabe, Shoji; Okubo, Takashi; Tokita, Koji

PA Showa Denko K. K., Japan

SO Jpn. Kokai Tokkyo Koho, 18 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM H01B001-12

ICS C08G061-02; H01G009-025; H01M006-18; H01M010-40

CC 76-10 (Electric Phenomena)

Section cross-reference(s): 38, 52, 72

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 10116513	A2	19980506	JP 1996-270942	19961014
PRAI JP 1996-270942		19961014		

AB The solid **electrolyte** contains (A) **polyoxyalkylenes** or

oligooxyalkylenes, (B) .gtoreq.1 **polymer** having **crosslinked** or branched (oxy)fluorocarbon structures, (C) .gtoreq.1 **electrolyte**, and (D) .gtoreq.1 filler with av. particle size 0.01-100 .mu.m. The electrode using the above solid **electrolyte** is manufd. by (1) immersing a **Polymerizable** compn. contg. (a) a thermally or active ray-**Polymerizable** compd. pendent with **Polymerizable** functional groups of CH₂=CR₁CO₂R₂- or CH₂=CR₃CO(OR₄)_xNHCO₂R₅- [R₁, R₃ = H, alkyl; R₂, R₅ = **Polyoxyalkylene**-, oligooxyalkylene-, or (oxy)fluorocarbon-contg. group; R₄ = C₁toreq.10 (heteroatom-contg.) divalent org. group; x = 0-10], (b) .gtoreq.1 **electrolyte**, and (c) .gtoreq.1 filler with av. particle size 0.01-100 .mu.m in a electrode or placing it on a support and (2) **polymg.** it. The electrode obtained by the above method, **batteries** using the electrode, and an elec. double-layer capacitor using the above solid electrolyte are also claimed. The electrolyte shows high ion cond. and heat resistance and good mold processability.

ST acrylic fluoro **Polyoxyalkylene** solid electrolyte; methacrylic fluoro **Polyoxyalkylene** solid electrolyte; **battery** electrode composite acrylic solid electrolyte; double layer capacitor solid electrolyte

IT Secondary **batteries**
Solid electrolytes
(acrylic (fluoro)**Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in **batteries** and double-layer capacitors and manufg. thereof)

IT Synthetic fibers
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(aluminum oxide, Rubiel TRA 08, filler; acrylic (fluoro) **Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in **batteries** and double-layer capacitors and manufg. thereof)

IT Capacitors
(double layer; acrylic (fluoro)**Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in **batteries** and double-layer capacitors and manufg. thereof)

IT **Polyoxyalkylenes**, uses
Polyoxyalkylenes, uses
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(fluorine-contg.; acrylic (fluoro)**Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in **batteries** and double-layer capacitors and manufg. thereof)

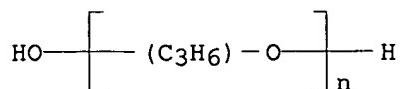
IT **Polyoxyalkylenes**, uses
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(methacrylate-terminated; acrylic (fluoro)**Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in **batteries** and double-layer capacitors and manufg. thereof)

IT Fluoropolymers, uses
Fluoropolymers, uses
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(**Polyoxyalkylene**-; acrylic (fluoro)**Polyoxyalkylene** solid electrolytes for compounding with electrodes useful in

- batteries and double-layer capacitors and manufg. thereof)
- IT **Polyoxyalkylenes**, uses
RL: DEV (Device component use); IMF (Industrial manufacture);
RCT (Reactant); TEM (Technical or engineered material use); PREP
(Preparation); RACT (Reactant or reagent); USES (Uses)
(triol derivs., reaction products with **isocyanatoethyl**
methacrylate, **polymers** with carbonates; acrylic (fluoro)
polyoxyalkylene solid **electrolytes** for compounding
with electrodes useful in **batteries** and double-layer
capacitors and manufg. thereof)
- IT 96-49-1DP, Ethylene carbonate, **polymers** with polypropylene
triols and **isocyanatoethyl** methacrylate 105-58-8DP, Diethyl
carbonate, **polymers** with polypropylene triols and
isocyanatoethyl methacrylate 25322-69-4DP, triol
derivs., reaction products with **isocyanatoethyl** methacrylate,
polymers with carbonates 30674-80-7DP, 2-**Isocyanatoethyl**
methacrylate, reaction products with polypropylene triols,
polymers with carbonates
RL: DEV (Device component use); IMF (Industrial manufacture);
RCT (Reactant); TEM (Technical or engineered material use); PREP
(Preparation); RACT (Reactant or reagent); USES (Uses)
(acrylic (fluoro)**polyoxyalkylene** solid **electrolytes**
for compounding with electrodes useful in **batteries** and
double-layer capacitors and manufg. thereof)
- IT 32171-39-4DP, **polymers** with polypropylene triol,
isocyanatoethyl methacrylate, and carbonates 107852-51-7DP,
Fomblin Z-DOL, reaction products with polyfluorocarbons and carbonates
203391-79-1DP, reaction products with **polyoxyfluoroalkylenes**,
isocyanatoethyl methacrylate, and carbonates
RL: DEV (Device component use); IMF (Industrial manufacture);
TEM (Technical or engineered material use); PREP (Preparation);
USES (Uses)
(acrylic (fluoro)**polyoxyalkylene** solid **electrolytes**
for compounding with electrodes useful in **batteries** and
double-layer capacitors and manufg. thereof)
- IT 375-01-9, 2,2,3,3,4,4,4-Heptafluoro-1-butanol
RL: RCT (Reactant); RACT (Reactant or reagent)
(acrylic (fluoro)**polyoxyalkylene** solid electrolytes for
compounding with electrodes useful in **batteries** and
double-layer capacitors and manufg. thereof)
- IT 429-06-1, Tetraethylammonium tetrafluoroborate 14283-07-9,
Lithium tetrafluoroborate 21324-40-3, Lithium
hexafluorophosphate
RL: DEV (Device component use); TEM (Technical or engineered material
use); USES (Uses)
(electrolyte; acrylic (fluoro)**polyoxyalkylene** solid
electrolytes for compounding with electrodes useful in
batteries and double-layer capacitors and manufg. thereof)
- IT 1344-28-1, Alumina, uses 7631-86-9, Aerosil RX 200, uses
RL: DEV (Device component use); TEM (Technical or engineered material
use); USES (Uses)
(filler; acrylic (fluoro)**polyoxyalkylene** solid electrolytes
for compounding with electrodes useful in **batteries** and
double-layer capacitors and manufg. thereof)
- IT 25322-69-4DP, triol derivs., reaction products with
isocyanatoethyl methacrylate, **polymers** with carbonates
RL: DEV (Device component use); IMF (Industrial manufacture);
RCT (Reactant); TEM (Technical or engineered material use); PREP

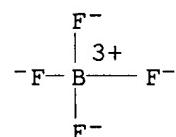
(Preparation); RACT (Reactant or reagent); USES (Uses)
 (acrylic (fluoro)polyoxyalkylene solid electrolytes
 for compounding with electrodes useful in batteries and
 double-layer capacitors and manufg. thereof)

RN 25322-69-4 HCPLUS
 CN Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-hydro-.omega.-hydroxy- (9CI)
 (CA INDEX NAME)

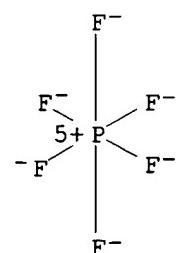


IT 14283-07-9, Lithium tetrafluoroborate 21324-40-3
 , Lithium hexafluorophosphate
 RL: DEV (Device component use); TEM (Technical or engineered material
 use); USES (Uses)
 (electrolyte; acrylic (fluoro)polyoxyalkylene solid
 electrolytes for compounding with electrodes useful in
 batteries and double-layer capacitors and manufg. thereof)

RN 14283-07-9 HCPLUS
 CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



RN 21324-40-3 HCPLUS
 CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



L21 ANSWER 21 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1998:72101 HCPLUS

DN 128:115626
 TI Synthesis and electrochemical characterization of **crosslinked**
 poly(ethylene oxide) containing LiN(CF₃SO₂)₂
 AU Carvalho, L. M.; Guegan, P.; Cheradame, H.; Gomes, A. S.
 CS Inst. Macromoleculas Univ. Federal Rio de Janeiro, Rio de Janeiro,
 21945-970, Brazil
 SO European Polymer Journal (1997), 33(10-12), 1741-1745
 CODEN: EUPJAG; ISSN: 0014-3057
 PB Elsevier Science Ltd.
 DT Journal
 LA English
 CC 37-5 (Plastics Manufacture and Processing)
 AB The ionic cond. of **polymeric electrolyte** systems comprising a network of poly(ethylene oxide) (PEO) **crosslinked** with 4,4',4''-methylidyne-tris(Ph **isocyanate**) [Desmodur RE] and contg. LiN(CF₃SO₂)₂ (TFSILi), was studied. **Polyurethanes** based on three different PEO mol. wts. were prep'd. Diffusion of TFSILi in swollen PEO-**urethane** membranes was studied using acetonitrile; the diffusion coeff. for PEO2000 was higher than that obsd. with LiClO₄ in the same material. The Tg of the dried membranes was detd. as a function of salt concn. and **crosslink** d. The effect of salts Tg (for the TFSILi charged membranes) is equiv. to 25% of the effect of a covalent **crosslink**, in the range of mol. wt. between **crosslinks**. The relatively high slope of the plot of Tg-1 vs. salt concn. for PEO600 suggests a high level of chain rigidity due to the salt. The cond. of the network based on PEO2000 with a molar concn. ratio O/Li = 43 is 10-5 S/cm.
 ST **Polyurethane PEO diisocyanate lithium triflimide cond; ionic cond PEO polyurethane electrolyte**
 IT **Polyurethanes, preparation**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
 (polyoxyalkylene-; prepn. and ionic cond. of electrolyte of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)
 IT **Crosslink density**
 Diffusion
 Electrolytes
 Glass transition temperature
 Ionic conductivity
 Polymer networks
 (prepn. and ionic cond. of **electrolyte** of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)
 IT **Polymer chains**
 (rigid; prepn. and ionic cond. of **electrolyte** of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)
 IT **90076-65-6, Lithium triflimide**
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
 (prepn. and ionic cond. of electrolyte of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)
 IT **75587-26-7P, Polyethylene glycol-triphenylmethane 4,4',4''-triisocyanate copolymer**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(prepn. and ionic cond. of electrolyte of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)

IT 150604-75-4, Desmodur RE

RL: RCT (Reactant); RACT (Reactant or reagent)

(prepn. and ionic cond. of electrolyte of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)

RE.CNT 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

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- (8) Guegan, P; Polym Prepr 1995, V34, P209
- (9) Le Nest, J; Macromolecules 1988, V21, P1117 HCPLUS
- (10) Lestel, L; Second International Symposium on Polymer Electrolytes 1990, P143 HCPLUS
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- (13) Takeoka, S; Polym Adv Technol 1993, V4, P53 HCPLUS
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- (16) Xu, K; Polym Adv Technol 1992, V3, P133 HCPLUS

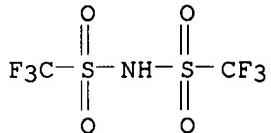
IT 90076-65-6, Lithium triflimide

RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)

(prepn. and ionic cond. of electrolyte of PEO-polyurethane-lithium triflimide as function of crosslink d. and salt concn.)

RN 90076-65-6 HCPLUS

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

L21 ANSWER 22 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 1996:273818 HCPLUS

DN 124:327255

TI Gelled electrolyte with good mechanical strength

IN Osada, Manabu; Akashi, Hiroyuki; Takemori, Shinichi; Sekai, Koji; Ozawa, Hitoshi; Nakajima, Kaoru; Karashima, Shuichi

PA Sumitomo Seika Kk, Japan; Sony Corp
 SO Jpn. Kokai Tokkyo Koho, 8 pp.
 CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM H01B001-06
 ICS C08G018-48; C08L075-08; H01M006-18

CC 72-3 (Electrochemistry)

Section cross-reference(s): 38, 52

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 08064028	A2	19960308	JP 1994-203249	19940829
PRAI	JP 1994-203249		19940829		

AB The **electrolyte** is obtained by treating a polyalkylene oxide with wt. av. mol. wt. 1000-1,000,000, a polyol, and an **isocyanate** compd. in the presence of an amine- and/or Sn-contg. catalyst, molding 100 parts of the resulting water-absorbing thermoplastic **polymer** and 0.1-20 parts of inorg. oxide, irradiating with 5-500-kGy electron beam, and impregnating with a soln. contg. an **electrolyte** and a nonaq. org. solvent. The electrolyte is useful for **Li batteries**, electrochem. devices, etc. The electrolyte showed high gel strength and good ionic cond.

ST polyalkylene **polyurethane** blend oxide electrolyte; electron beam **crosslinking** polyalkylene **polyurethane** electrolyte

IT Absorbents
 (for water; gelled electrolyte contg. electron-beam-**crosslinked** polyalkylene-**polyurethane** and inorg. oxide with good gel strength)

IT **Battery electrolytes****Crosslinking**

Electron beam

Gels

(gelled electrolyte contg. electron-beam-**crosslinked** polyalkylene-**polyurethane** and inorg. oxide with good gel strength)

IT Electrolytes

(manuf. of gelled electrolyte with good mech. strength)

IT **Urethane polymers, uses**

RL: TEM (Technical or engineered material use); USES (Uses)

(**polyoxyalkylene-**, gelled **electrolyte** contg.
 electron-beam-**crosslinked** polyalkylene-**polyurethane**
 and inorg. oxide with good gel strength)

IT 77-58-7, Dibutyltin dilaurate 102-71-6, Triethanolamine, uses

121-44-8, Triethylamine, uses 280-57-9, Triethylenediamine 301-10-0,
 Stannous octoate 1067-33-0

RL: CAT (Catalyst use); USES (Uses)

(catalysts; in manuf. of gelled electrolyte with good mech. strength)

IT 1309-48-4, Magnesium oxide, uses 1314-13-2, Finex 25, uses 1344-28-1,

Aluminum oxide, uses 7791-03-9, **Lithium** perchlorate

13463-67-7, MT 500B, uses 14283-07-9, **Lithium**
tetrafluoroborate 21324-40-3, **Lithium**

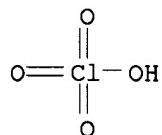
hexafluorophosphate 84135-65-9, Finesil T 32 112153-70-5, Aerosil R 805

RL: NUU (Other use, unclassified); USES (Uses)

(in manuf. of gelled electrolyte with good mech. strength)

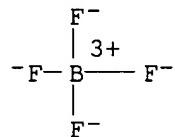
IT 107040-16-4 107678-92-2 176676-78-1, Hexamethylene
diisocyanate-1,9-nonenediol-**polyethylene oxide**

block copolymer 176676-79-2, 4,4'-Diphenylmethane **diisocyanate**
-ethylene glycol-**polyethylene oxide-polypropylene**
oxide block copolymer 176676-80-5
RL: TEM (Technical or engineered material use); USES (Uses)
(in manuf. of gelled electrolyte with good mech. strength)
IT 96-48-0, .gamma.-Butyrolactone 108-32-7, Propylene carbonate
RL: NUU (Other use, unclassified); USES (Uses)
(solvent; in manuf. of gelled electrolyte with good mech. strength)
IT 7791-03-9, Lithium perchlorate 14283-07-9,
Lithium tetrafluoroborate 21324-40-3, Lithium
hexafluorophosphate
RL: NUU (Other use, unclassified); USES (Uses)
(in manuf. of gelled electrolyte with good mech. strength)
RN 7791-03-9 HCPLUS
CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)

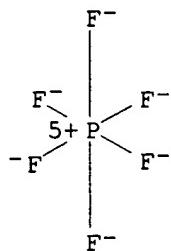


Li

RN 14283-07-9 HCPLUS
CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

 Li^+

RN 21324-40-3 HCPLUS
CN Phosphate(1-), hexafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

 Li^+

L21 ANSWER 23 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1996:169144 HCAPLUS
 DN 124:207235
 TI Curable polymer precursors for solid electrolytes from vinyl sulfonate-terminated polyoxyalkylenes linked by urethane with polyesters
 IN Golovin, Milton N.
 PA USA
 SO U.S., 5 pp. Cont.-in-part of U.S. 5,262,253.
 CODEN: USXXAM
 DT Patent
 LA English
 IC ICM H01M010-40
 NCL 429192000
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38

FAN.CNT 3

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5489491	A	19960206	US 1994-230569	19940420
	US 5262253	A	19931116	US 1992-918438	19920722
	US 5498491	A	19960312	US 1994-193046	19940204
	WO 9529514	A1	19951102	WO 1995-US4459	19950410
	W:	AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT			
	RW:	KE, MW, SD, SZ, UG, AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG			
	AU 9522854	A1	19951116	AU 1995-22854	19950410
PRAI	US 1992-918438	A2	19920722		
	US 1993-168881	B2	19931215		
	WO 1993-US6854	W	19930722		
	US 1994-230569	A	19940420		
	WO 1995-US4459	W	19950410		
AB	Vinyl sulfonate-derivatized oligomers of poly(oxyalkylene)glycols or polyesters and isocyanate are urethane-linked polymer precursors for the solid polymeric matrix of a solid electrolyte. The solid electrolyte polymer precursor can be represented by $V_k Y R_2 k$ where k is 1 or				

2; R is H or C1-6 alkyl; V is CH₂:CR₅SO₂-, Y is -O(ZnD)_qZn- where Zn is -(R₂OOC(O)R₃C(O)O)n-; D is -C(O)NHR₄NHC(O)O-; R₁ is H or C1-3 alkyl; R₂ is C1-12 hydrocarbylene or oxyhydrocarbylene; R₃ and R₄ are independently C1-12 hydrocarbylene groups; R₅ is H or C1-7 hydrocarbyl; n is 1-50; and q is 1-100. The solid polymeric matrix is made by **crosslinking** the vinyl sulfonate-derivatized oligomer.

ST **polymer precursor solid electrolyte; polyester polyoxyalkylene urethane linked electrolyte**

IT **Battery electrolytes**

(curable **polymer precursors for solid battery electrolytes**)

IT **Polyoxyalkylenes, uses**

RL: TEM (Technical or engineered material use); USES (Uses)
(polyester-, **urethane**-linked, vinyl sulfonate-terminated;
curable **polymer precursors for solid battery electrolytes**)

IT **Polyesters, uses**

RL: TEM (Technical or engineered material use); USES (Uses)
(**polyoxyalkylene**-, **urethane**-linked, vinyl sulfonate-terminated; curable **polymer precursors for solid battery electrolytes**)

IT 7440-44-0, Carbon, uses

RL: DEV (Device component use); USES (Uses)
(anode, intercalatable; curable **polymer precursors for solid battery electrolytes**)

IT 1314-62-1, Vanadium oxide, uses 52627-24-4, Cobalt **lithium** oxide

RL: DEV (Device component use); USES (Uses)
(cathode; curable **polymer precursors for solid battery electrolytes**)

L21 ANSWER 24 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 1995:796362 HCPLUS

DN 123:259069

TI An NMR investigation of ionic structure and mobility in plasticized solid **polymer electrolytes**

AU Forsyth, M.; MacFarlane, D. R.; Meakin, P.; Smith, M. E.; Bastow, T. J.

CS Dep. Materials Engineering, Monash Univ., Clayton, 3168, Australia

SO Electrochimica Acta (1995), 40(13-14), 2343-7

CODEN: ELCAAV; ISSN: 0013-4686

PB Elsevier

DT Journal

LA English

CC 38-3 (Plastics Fabrication and Uses)

AB 23Na and 19F NMR spectroscopy is used to investigate the effect of plasticizer addn. on ionic structure and mobility in a **urethane crosslinked** polyether solid **polymer electrolyte**

. The incorporation of DMF and propylene carbonate plasticizers in a sodium triflate/polyether system results in an upfield chem. shift for the 23Na resonance consistent with decreased anion-cation assocn. and increased cation-plasticizer interactions. The 19F resonances appears less susceptible to changes in chem. environment with only minor chem. shift changes recorded. Spin lattice relaxation measurements for the 19F nucleus are also reported. Two min. are obsd. in the relaxation measurements consistent with both an inter and intramol. relaxation mechanism.

ST ionic structure plasticized solid **polymer electrolyte**;
mobility plasticized solid **polymer electrolyte**;

lithium complex urethane crosslinked
 polyoxyalkylene
 IT Battery electrolytes
 Chains, chemical
 (NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT Polyoxalkylenes, uses
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (lithium complexes, electrolytes contg.
 trifluoromethanesulfonate; NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT Magnetic relaxation
 (spin-lattice, NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT 68-12-2, Dimethyl formamide, uses 108-32-7, Propylene carbonate
 RL: NUU (Other use, unclassified); USES (Uses)
 (NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT 7439-93-2D, Lithium, Ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer complexes
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (battery electrolytes; NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT 25766-15-8D, Ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer, lithium complexes
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (electrolytes contg. trifluoromethanesulfonate; NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 IT 7439-93-2D, Lithium, Ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer complexes
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (battery electrolytes; NMR investigation of ionic structure and mobility in plasticized solid polymer electrolytes)
 RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 25 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1995:796361 HCPLUS
 DN 123:259068
 TI A ¹³C NMR study of the role of plasticizers in the conduction mechanism of solid polymer electrolytes
 AU Forsyth, M.; Meakin, P. M.; MacFarlane, D. R.
 CS Dep. Materials Engineering, Monash Univ., Clayton, 3168, Australia
 SO Electrochimica Acta (1995), 40(13-14), 2339-42
 CODEN: ELCAAV; ISSN: 0013-4686
 PB Elsevier

DT Journal
LA English
CC 38-3 (Plastics Fabrication and Uses)
AB The addn. of low mol. wt. solvents such as DMF (DMF) and propylene carbonate (PC) to **urethane crosslinked polyethers** results in enhancement of polymer segmental motion, as detd. in this work from polymer ^{13}C spin lattice relaxation measurements (T_1) and glass transition temps. The formation of salt-polyether complexes results in a decrease in T_1 , even in the presence of the plasticizer, indicating that the polymer ether mols. are still involved in the alkali metal coordination. In a **polymer electrolyte** contg. 1 mol kg-1 LiClO₄ the addn. of DMF and PC have significantly different affects on the **polymer** mobility, although they both enhance the cond. The cond. enhancement therefore is not solely the result of an increased solvent mobility.
ST plasticizer effect mechanism solid **polymer electrolyte**; **urethane crosslinked polyoxyalkylene battery electrolyte**
IT Chains, chemical
Glass temperature and transition
(^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT **Polyoxyalkylenes, uses**
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**lithium complexes, battery electrolytes**;
 ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT Magnetic relaxation
(spin-lattice, ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT 68-12-2, Dimethyl formamide, uses
RL: NUU (Other use, unclassified); USES (Uses)
(A ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT 25766-15-8D, Ethylene oxide-hexamethylene **diisocyanate**-propylene oxide copolymer, sodium or **lithium** complexes
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**battery electrolytes**; ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT 7791-03-9, Lithium perchlorate
RL: NUU (Other use, unclassified); USES (Uses)
(**electrolytes** with ethylene oxide-hexamethylene **diisocyanate**-propylene oxide copolymer; ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT 2926-30-9, Sodium trifluoromethanesulfonate
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**electrolytes** with ethylene oxide-hexamethylene **diisocyanate**-propylene oxide copolymer; ^{13}C NMR study of the role of plasticizers in the conduction mechanism of solid **polymer electrolytes**)
IT 108-32-7, Propylene carbonate
RL: NUU (Other use, unclassified); USES (Uses)
(^{13}C NMR study of the role of plasticizers in the conduction mechanism

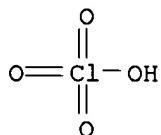
of solid polymer electrolytes)

IT 7439-93-2D, Lithium, complexes with ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer
 7440-23-5D, Sodium, complexes with ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (13C NMR study of the role of plasticizers in the conduction mechanism of solid polymer electrolytes)

IT 7791-03-9, Lithium perchlorate
 RL: NUU (Other use, unclassified); USES (Uses)
 (electrolytes with ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer; 13C NMR study of the role of plasticizers in the conduction mechanism of solid polymer electrolytes)

RN 7791-03-9 HCPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

IT 7439-93-2D, Lithium, complexes with ethylene oxide-hexamethylene diisocyanate-propylene oxide copolymer
 RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (13C NMR study of the role of plasticizers in the conduction mechanism of solid polymer electrolytes)

RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 26 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1995:796350 HCPLUS
 DN 123:318645
 TI Polymer electrolytes based on modified polysaccharides. 2. Polyether-modified celluloses
 AU Schoenenberger, C.; Le Nest, J. F.; Gandini, A.
 CS Materiaux Polymères, INPG, St. Martin d'Hères, 38402, Fr.
 SO Electrochimica Acta (1995), 40(13-14), 2281-4
 CODEN: ELCAAV; ISSN: 0013-4686
 PB Elsevier
 DT Journal
 LA English
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 37

AB In order to improve the film-forming properties of polyether-based **polymer electrolytes** a new family of materials was synthesized. The structures described in this work involve a cellulosic ether backbone on which oligoethers were grafted and **crosslinked** in various proportions via **urethane** chem. and to which **lithium perchlorate** was subsequently added as a source of ionic species. The resulting networks were fully characterized in terms of glass transition temp. dynamic mech. properties and ionic cond. With respect to the optimized polyether-based networks studied previously, the introduction of polysaccharide chains does not alter the basic features neither qual. nor quant.

ST **battery electrolyte polymer** modified polysaccharide; polyether modified cellulosic **battery** electrolyte

IT **Battery** electrolytes

Glass temperature and transition
(electrolytes based on reaction of cellulose ethers with polyether-based **isocyanates**)

IT Electric conductivity and conduction

(ionic, electrolytes based on reaction of cellulose ethers with polyether-based **isocyanates**)

IT 9004-62-0D, Hydroxyethylcellulose, **polymers** with polypropylene

oxide **isocyanates** and PEO **disocyanates**

25322-68-3D, Polyethyleneoxide, **isocyanates**,

polymers with hydroxyethylcellulose 25322-69-4D,

Polypropylene oxide, **isocyanates**, **polymers** with hydroxyethylcellulose

RL: PRP (Properties)

(**electrolytes** based on reaction of cellulose ethers with polyether-based **isocyanates**)

IT 7791-03-9, **Lithium** perchlorate

RL: PRP (Properties)

(electrolytes based on reaction of cellulose ethers with polyether-based **isocyanates** and)

IT 25322-68-3D, Polyethyleneoxide, **isocyanates**,

polymers with hydroxyethylcellulose 25322-69-4D,

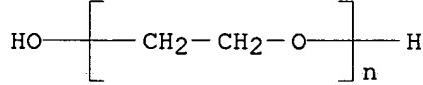
Polypropylene oxide, **isocyanates**, **polymers** with hydroxyethylcellulose

RL: PRP (Properties)

(**electrolytes** based on reaction of cellulose ethers with polyether-based **isocyanates**)

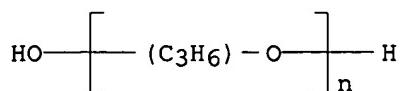
RN 25322-68-3 HCAPLUS

CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)

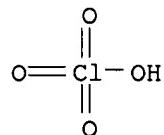


RN 25322-69-4 HCAPLUS

CN Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



IT 7791-03-9, Lithium perchlorate
 RL: PRP (Properties)
 (electrolytes based on reaction of cellulose ethers with
 polyether-based isocyanates and)
 RN 7791-03-9 HCPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 27 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1995:637272 HCPLUS
 DN 123:57315
 TI Conductivity studies of polymer electrolytes based on
 aliphatic polyesters
 AU Kim, Dong-Won; Park, Jung-Ki; Gong, Myoung-Seon
 CS Dep. Chem. Eng., Korea Adv. Inst. Sci. Technol., Daejon, 305-701, S. Korea
 SO Journal of Polymer Science, Part B: Polymer Physics (1995), 33(9), 1323-31
 CODEN: JPBPEM; ISSN: 0887-6266
 PB Wiley
 DT Journal
 LA English
 CC 37-3 (Plastics Manufacture and Processing)
 Section cross-reference(s): 39, 76
 AB A series of aliph. polyesters of sebacoyl chloride and poly(ethylene
 glycol) contg. a different no. of ethylene oxide groups was synthesized
 and characterized. These polyesters were complexed with lithium
 perchlorate to obtain a new class of polymer electrolyte
 . The relationships between the structure and properties of these
 polymer electrolytes were investigated. The main factor
 that affects the ionic cond. in these systems was the solvating capacity
 of the polyester for the lithium salt. These polymer
 electrolytes showed ionic conductivities up to 10-5-10-4 S/cm at
 25.degree.. The mech. strength was improved by crosslinking,
 and the crosslinked polyester complexed with a LiClO₄ salt
 showed an ionic cond. of 2 .times. 10-5 S/cm at room temp. ⁷Li NMR
 spin-spin relaxation and dielec. relaxation studies were also carried out
 to investigate the local environment and dynamics of ions in the
 polymer electrolytes.
 ST aliph polyester lithium complex polyelectrolyte;
 polyethylene glycol polyester lithium complex;
 ionic cond polyester polyoxyalkylene complex

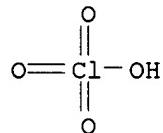
- IT Rubber, **urethane**, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
(hexamethylene diisocyanate-polyethylene glycol-polyoxypylene triol-sebacoyl chloride, lithium complexes; ionic cond. of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT Crystallinity
Electrolytes
Glass temperature and transition
Heat of fusion and Heat of freezing
(ionic cond. and thermal properties of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT Electric conductivity and conduction
(ionic, ionic cond. and thermal properties of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT **Polyoxyalkylenes**, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
(polyester-, ionic cond. of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT **Polyoxyalkylenes**, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
(polyester-, metal complexes, ionic cond. of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT Polyesters, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
(polyoxyalkylene-, ionic cond. of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT Polyesters, preparation
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)
(polyoxyalkylene-, metal complexes, ionic cond. of aliph. polyester-polyoxyalkylene-based polymer electrolytes)
- IT 7791-03-9DP, complexes with polyester-polyoxyalkylenes
28650-91-1DP, Triethylene glycol-sebacoyl chloride copolymer, sru, lithium complexes 28650-91-1P, Triethylene glycol-sebacoyl chloride copolymer, sru 164854-23-3DP, Triethylene glycol-sebacoyl chloride copolymer, lithium complexes 164854-23-3P, Triethylene glycol-sebacoyl chloride copolymer 164854-24-4DP, Tetraethylene glycol-sebacoyl chloride copolymer, lithium complexes 164854-24-4P, Tetraethylene glycol-sebacoyl chloride copolymer 164854-25-5DP, Tetraethylene glycol-sebacoyl chloride copolymer, sru, lithium complexes 164854-25-5P, Tetraethylene glycol-sebacoyl chloride copolymer, sru 164854-26-6DP, Hexaethylene glycol-sebacoyl chloride copolymer, lithium complexes 164854-26-6P, Hexaethylene glycol-sebacoyl chloride copolymer 164854-27-7DP, Hexaethylene glycol-sebacoyl chloride copolymer, sru, lithium complexes 164854-27-7P, Hexaethylene glycol-sebacoyl chloride copolymer, sru 164854-28-8DP, Nonaethylene glycol-sebacoyl chloride copolymer, lithium complexes 164854-28-8P, Nonaethylene glycol-sebacoyl chloride copolymer 164854-29-9DP, Nonaethylene glycol-sebacoyl chloride copolymer, sru, lithium complexes 164854-29-9P, Nonaethylene glycol-sebacoyl chloride copolymer, sru 164854-30-2DP, **Polyethylene glycol-sebacoyl chloride copolymer**,

lithium complexes 164854-30-2P, **Polyethylene glycol-sebacoyl chloride copolymer**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP
(Preparation)
 (ionic cond. of aliph. polyester-**polyoxyalkylene**-based
polymer electrolytes)

IT 111-19-3DP, Sebacoyl chloride, **polymer** with hexamethylene
 diisocyanate, poly(ethylene glycol) and poly(propylene oxide)
 triol deriv., lithium complexes 822-06-0DP,
 Hexamethylene diisocyanate, **polymer** with poly(ethylene
 glycol), poly(propylene oxide) triol deriv. and sebacoyl chloride,
 lithium complexes 25322-68-3DP, **polymer** with
 hexamethylene diisocyanate, poly(propylene oxide) triol deriv.
 and sebacoyl chloride, lithium complexes 25322-69-4DP,
 triol derivs., **polymer** with hexamethylene diisocyanate
 , poly(ethylene glycol) and sebacoyl chloride, lithium complexes
 RL: PRP (Properties); SPN (Synthetic preparation); PREP
(Preparation)
 (rubber; ionic cond. of aliph. polyester-**polyoxyalkylene**
 -based **polymer electrolytes**)

IT 7791-03-9DP, complexes with polyester-**polyoxyalkylenes**
 RL: PRP (Properties); SPN (Synthetic preparation); PREP
(Preparation)
 (ionic cond. of aliph. polyester-**polyoxyalkylene**-based
polymer electrolytes)

RN 7791-03-9 HCAPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



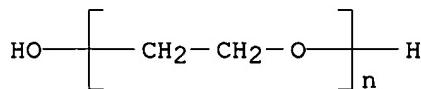
● Li

IT 822-06-0DP, Hexamethylene diisocyanate, **polymer**
 with poly(ethylene glycol), poly(propylene oxide) triol deriv. and
 sebacoyl chloride, lithium complexes 25322-68-3DP,
 polymer with hexamethylene diisocyanate, poly(propylene
 oxide) triol deriv. and sebacoyl chloride, lithium complexes
 25322-69-4DP, triol derivs., **polymer** with hexamethylene
 diisocyanate, poly(ethylene glycol) and sebacoyl chloride,
 lithium complexes
 RL: PRP (Properties); SPN (Synthetic preparation); PREP
(Preparation)
 (rubber; ionic cond. of aliph. polyester-**polyoxyalkylene**
 -based **polymer electrolytes**)

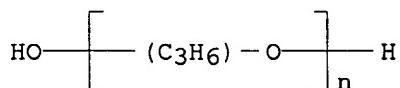
RN 822-06-0 HCAPLUS
 CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

OCN—(CH₂)₆—NCO

RN 25322-68-3 HCPLUS
 CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



RN 25322-69-4 HCPLUS
 CN Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



L21 ANSWER 28 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1994:413912 HCPLUS
 DN 121:13912
 TI Gel electrolytes for lithium batteries sand electrochemical devices
 IN Yamamoto, Takushi; Sekai, Kohji; Nakamura, Morio; Nishi, Yoshio; Tanaka, Hitoshi; Ozawa, Hitoshi; Maeda, Nobuhivo
 PA Sumitomo Seika Chemicals Co., Ltd., Japan; Sony Corp.
 SO PCT Int. Appl., 23 pp.
 CODEN: PIXXD2
 DT Patent
 LA Japanese
 IC ICM H01M006-18
 ICS H01M006-22; H01M010-40
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 37, 38
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 9406165	A1	19940317	WO 1993-JP1272	19930908
	W: US				
	RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
	JP 06140052	A2	19940520	JP 1993-206306	19930820
PRAI	JP 1992-239418		19920908		
	JP 1993-206306		19930820		
AB	The gel electrolytes comprise a matrix contg. 0.2-20 wt. parts inorg. oxides and 100 wt. parts poly(alkylene oxide) having wt. av. mol. wt. 1000-1,000,000 crosslinked by isocyanates and a nonaq. soln of an inorg. electrolyte impregnated in the matrix. The electrolytes have high cond. and mech. strength.				
ST	lithium battery gelled electrolyte; polyalkylene oxide electrolyte lithium battery ; inorg oxide additive battery gelled electrolyte				
IT	Battery electrolytes (gelled, polymer matrixes contg. inorg oxides for)				
IT	Urethane polymers , uses				

RL: USES (Uses)
 (polyoxyalkylene-, matrixes contg. inorg. oxides and, gelled electrolytes contg., for lithium batteries)

IT 7791-03-9, Lithium perchlorate 14283-07-9,
 Lithium fluoroborate
 RL: USES (Uses)
 (electrolyte, polymer matrixes contg. inorg. oxides for gelled, in lithium batteries)

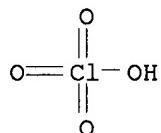
IT 9042-77-7 9059-74-9 25766-14-7 37278-61-8 60941-30-2
 RL: USES (Uses)
 (matrixes contg. inorg. oxides and, gelled electrolytes contg., for lithium batteries)

IT 1309-48-4, Magnesia, uses 1314-13-2, Zinc oxide, uses 1344-28-1, Alumina, uses 7631-86-9, Silica, uses 13463-67-7, Titania, uses
 RL: USES (Uses)
 (polymer matrixes contg., gelled electrolytes contg., for lithium batteries)

IT 96-48-0, .gamma.-Butyrolactone 108-32-7, Propylene carbonate
 RL: USES (Uses)
 (solvent, gelled electrolytes contg., polymer matrixes contg. inorg. oxides for, in lithium batteries)

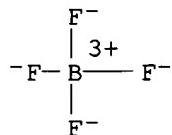
IT 7791-03-9, Lithium perchlorate 14283-07-9,
 Lithium fluoroborate
 RL: USES (Uses)
 (electrolyte, polymer matrixes contg. inorg. oxides for gelled, in lithium batteries)

RN 7791-03-9 HCPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 14283-07-9 HCPLUS
 CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

Li⁺

L21 ANSWER 29 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1994:137487 HCAPLUS
 DN 120:137487
 TI Macromolecular materials based on polysaccharides for ionic conductors
 IN Gandini, Alessandro; Le Nest, Jean Francois
 PA Institut National Polytechnique de Grenoble, Fr.
 SO PCT Int. Appl., 21 pp.
 CODEN: PIXXD2
 DT Patent
 LA French
 IC ICM C08B015-00
 ICS C08B031-00; C08B033-00; C08B037-08; C08B037-14; H01M006-18;
 H01M010-40
 CC 43-3 (Cellulose, Lignin, Paper, and Other Wood Products)
 Section cross-reference(s): 44, 52, 76
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 9316108	A1	19930819	WO 1993-FR140	19930211
	W: CA, JP, US RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE FR 2687405		19930820	FR 1992-1581	19920213
PRAI	FR 1992-1581		19920213		

AB The title materials, with good mech. and film-forming properties and useful as solid electrolytes, comprise linear or branched oligo- or polysaccharides and/or their derivs. bearing solvating and anionic groups. Heating 3 g cellulose and 6 g **polyoxyethylene diisocyanate** (mol. wt. 600) with a Sn catalyst in DMSO at 60.degree. for 24 h gave a gel which was extd. with CH₂Cl₂, dried, and impregnated with 10% LiClO₄ to give a membrane with glass temp. -30.degree., elec. cond. 10-5 S/cm at 25.degree., and elastic modulus 107 Pa at 25.degree..

ST elec conductor ionic polysaccharide; **polyurethane cellulose solid electrolyte; polyoxyalkylene polyurethane cellulose crosslinking** polyelectrolyte; electrolyte solid cellulose **polyurethane; lithium perchlorate polysaccharide** electrolyte

IT **Battery** electrolytes
 (polysaccharide-based, solid)

IT Phosphazene polymers
 Polyamines
 Polysulfides
 Siloxanes and Silicones, uses
 RL: USES (Uses)
 (polysaccharide-contg., lithium salt-impregnated, as solid **electrolytes**)

IT Oligosaccharides
 RL: USES (Uses)
 (derivs., ionic, lithium salt-impregnated, as solid **electrolytes**)

IT Windows
 (electrochromic, polysaccharide-based solid electrolytes for use in)

IT Polysaccharides, uses
 RL: USES (Uses)
 (ionic, lithium salt-impregnated, as solid electrolytes)

IT **Polyoxyalkylenes**, uses
 RL: USES (Uses)
 (polyester-, cellulose-based, lithium salt-impregnated, as

solid electrolytes)

IT Polyesters, uses
Urethane polymers, uses
 RL: USES (Uses)
 (polyoxyalkylene-, cellulose-based, lithium salt-impregnated, as solid **electrolytes**)

IT Electrolytes
 (solid, ionic polysaccharides for use in)

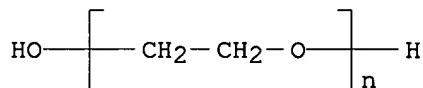
IT 1189-71-5D, Chlorosulfonyl **isocyanate**, reaction products with cellulose-based **polyurethanes** 1398-61-4D, Chitin, ionic derivs. 2370-88-9D, 2,4,6,8-Tetramethylcyclotetrasiloxane, reaction products with polyoxyethylated Me cellulose 9004-34-6D, Cellulose, reaction products with **polyoxyethylene diisocyanates** 9004-62-0D, 2-Hydroxyethyl cellulose, reaction products with **polyoxyethylene diisocyanates** 9004-67-5D, Methyl cellulose, ethers with **Polyethylene glycol**, reaction products with tetramethylcyclotetrasiloxane 9005-25-8D, Starch, ionic derivs. 9005-82-7D, Amylose, reaction products with **polyoxyethylene diisocyanates** 9012-76-4D, Chitosan, ionic derivs. 9034-32-6D, Hemicellulose, ionic derivs.
25322-68-3D, Polyethylene glycol, diisocyanate derivs., reaction products with cellulose
 RL: USES (Uses)
 (lithium salt-impregnated, as solid electrolytes)

IT 7791-03-9, Lithium perchlorate 33454-82-9,
 Lithium trifluoromethanesulfonate 90076-65-6,
 Lithium bis(trifluoromethanesulfonyl)imide
 RL: USES (Uses)
 (polysaccharides impregnated with, as solid electrolytes)

IT 25322-68-3D, **Polyethylene glycol, diisocyanate** derivs., reaction products with cellulose
 RL: USES (Uses)
 (lithium salt-impregnated, as solid electrolytes)

RN 25322-68-3 HCPLUS

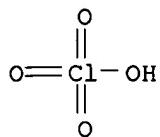
CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



IT 7791-03-9, Lithium perchlorate 33454-82-9,
 Lithium trifluoromethanesulfonate 90076-65-6,
 Lithium bis(trifluoromethanesulfonyl)imide
 RL: USES (Uses)
 (polysaccharides impregnated with, as solid electrolytes)

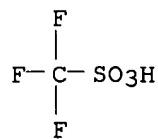
RN 7791-03-9 HCPLUS

CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



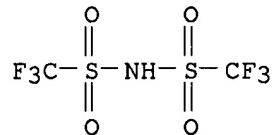
Li

RN 33454-82-9 HCPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 90076-65-6 HCPLUS
 CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

L21 ANSWER 30 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1992:491879 HCPLUS
 DN 117:91879
 TI Functionalized polyether-type ion-conducting **polymer electrolytes**
 IN Motogami, Kenji; Mori, Shigeo
 PA Daiichi Kogyo Seiyaku K. K., Japan
 SO Jpn. Kokai Tokkyo Koho, 12 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM C08L071-02
 ICS C08F299-02; C08G018-48; H01B001-06; H01M006-18; H01M010-40
 CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 72

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 04068064	A2	19920303	JP 1990-180355	19900706
	JP 2923542	B2	19990726		
PRAI	JP 1990-180355		19900706		
AB	<p>The title polyethers, being used with sol. electrolyte salts and O- and/or N-contg. org. solvents, have low glass-transition temp. (Tg), and are amorphous polymers obtained by the crosslinking of the active H-contg. compd.-initiated block or random addn. products of glycidyl ethers and C_{gtoreq.3} alkylene oxides which bear terminal functional groups. The amorphous nature of the polymers can prevent the sudden decrease of cond. at low temp. as seen in cryst. similar polymers. Thus, the KOH-catalyzed reaction of glycerol initiator 15 with 1,2-epoxybutane 370, then with glycidyl triethylene glycol Me ether 285 g gave a polyether which was esterified with acrylic acid (I) at the OH/I equiv. wt. ratio 1.1:1. Heating 3.6 g the acrylate polyether-polyol with 0.12 g LiClO₄ and a MEK soln. of photoinitiator under N at 80.degree. for 1 h and in vacuo for 8 h to remove MEK, and impregnating into 1.8 g propylene carbonate gave a title product which showed ion cond. 1.8x10⁻⁴, 1.0x10⁻⁴, and 5.2x10⁻⁵ s/cm at 20, 0 and -20.degree., resp.</p>				
ST	<p>complex polyether polyol crosslinked electrolyte; polyoxalkylene polyol acrylate polymer electrolyte; lithium perchlorate polyoxalkylene acrylate polymer</p>				
IT	<p>Electric conductors Polyelectrolytes (prepn. of, amorphous polyoxalkylene-polyol-based acrylic polymers or urethane polymer complexes for)</p>				
IT	<p>Epoxides RL: PREP (Preparation) (C12, polymers, with glycidyl ethers, ether with sorbitol, methacrylate, polymers, metal complexes, electrolytes, prepn. of)</p>				
IT	<p>Epoxides RL: PREP (Preparation) (C4, polymers, with glycidyl ethers, ether with sorbitol, methacrylate, polymers, metal complexes, electrolytes, prepn. of)</p>				
IT	<p>Epoxides RL: PREP (Preparation) (C6, polymers, with glycidyl ethers, ether with sorbitol, methacrylate, polymers, metal complexes, electrolytes, prepn. of)</p>				
IT	<p>Polyoxalkylenes, preparation RL: PREP (Preparation) (acrylic, polyol-initiated, electrolytes, prepn. of ion-conducting and amorphous)</p>				
IT	<p>Acrylic polymers, preparation Urethane polymers, preparation RL: PREP (Preparation) (polyoxalkylene-, polyol-initiated, electrolytes, prepn. of ion-conducting and amorphous)</p>				
IT	<p>50-70-4D, Sorbitol, ether with mixed oxirane compds., methacrylated, polymers, lithium complexes 79-41-4D, ester with polymers of C12 .alpha.-olefin oxide and glycidyl ether initiated by sorbitol, polymers, lithium complex 80-05-7D,</p>				

ether with mixed oxirane compds., polymers, polymer with polyisocyanates, lithium complexes 107-21-1D, 1,2-Ethanediol, ether with mixed oxirane compds., methacrylated, polymers, lithium complexes 822-06-0D, polymers with polyether-polyols, lithium complex 930-37-0D, Methyl glycidyl ether, polymers with C4 .alpha.-olefin oxide, ether with diols, methacrylated, polymers, lithium complexes 4067-16-7D, Pentaethylenehexamine, ether with mixed oxirane compds., methacrylated, polymers, lithium complexes 7439-93-2D, Lithium, polyether-polyol-based polymer complexes 14435-47-3D, polymers with C6 .alpha.-olefin oxide, ether with polyamines, methacrylated, polymers, lithium complexes 40349-67-5D, polymers with C12 .alpha.-olefin oxide, ether with sorbitol, methacrylates, polymers, lithium complexes 134966-38-4D, polymers with C12 .alpha.-olefin oxide, ether with polyamines, methacrylated, polymers, lithium complexes 142661-73-2D, lithium complex 142743-34-8D, lithium complex 142743-35-9D, lithium complex 142743-36-0D, lithium complex 142953-73-9D, lithium complex 142953-74-0D, lithium complex

RL: USES (Uses)

(electrolytes, prepн. of ion-conducting and amorphous)

IT 96-48-0 108-32-7, Propylene carbonate

RL: USES (Uses)

(solvents, for amorphous polopolyoxyalkylene-polyol-based acrylic polymers or urethane polymer lithium complexes)

IT 822-06-0D, polymers with polyether-polyols, lithium complex 7439-93-2D, Lithium, polyether-polyol-based polymer complexes

RL: USES (Uses)

(electrolytes, prepн. of ion-conducting and amorphous)

RN 822-06-0 HCPLUS

CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

OCN—(CH₂)₆—NCO

RN 7439-93-2 HCPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 31 OF 44 HCPLUS COPYRIGHT 2003 ACS

AN 1992:84807 HCPLUS

DN 116:84807

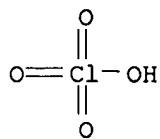
TI Solid polymer electrolytes of lithium salts and polyethylene glycols crosslinked with a siloxane-based tetraisocyanate

AU Xia, Du Wei; Zhou, Guangbin; Smid, Johannes

CS Coll. Environ. Sci. For., State Univ. New York, Syracuse, NY, 13210, USA

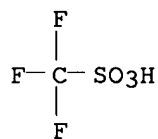
SO Integr. Fundam. Polym. Sci. Technol.--5, [Proc. Int. Meet. Polym. Sci. Technol., Rolduc Polym. Meet.--5], 5th (1991), Meeting Date 1990, 395-9. Editor(s): Lemstra, P. J.; Kleintjens, L. A. Publisher: 44-50, London, UK.

CODEN: 57HAAD
DT Conference
LA English
CC 37-5 (Plastics Manufacture and Processing)
Section cross-reference(s): 52, 76
AB Solvent-free electrolyte complexes with elec. cond. (σ) approaching 10^{-3} S/cm at 90.degree. were formed when LiClO₄ or LiCF₃SO₃ are solubilized in networks of polyoxyethylenes and an aliph. **tetraisocyanate** made from α,α -di-Me m-isopropenylbenzyl **isocyanate** and cyclotetrasiloxane. The value of σ . increased to close to 10^{-2} S/cm on adding 30 wt% propylene carbonate, while the room-temp. σ . reached 2×10^{-3} S/cm.
ST lithium siloxane **isocyanate polyoxyethylene** electrolyte; solid polyelectrolyte **polyoxyethylene** network cond
IT Electric conductors, polymeric
(**isocyanate-contg. siloxane-crosslinked**
polyoxyethylene lithium complex networks, prepn. and performance of)
IT Electric conductivity and conduction
(of **isocyanate-contg. siloxane-crosslinked**
polyoxyethylene lithium complex networks)
IT Glass temperature and transition
(of **isocyanate-contg. siloxane-crosslinked**
polyoxyethylene lithium complex networks, elec. cond. in relation to)
IT Cyclosiloxanes
RL: **SPN (Synthetic preparation); PREP (Preparation)**
(Me, **isocyanate** group-contg., tetrafunctional,
polymers with polyoxyethylenes, solid **electrolytes** from, prepn. and cond. of)
IT Polyelectrolytes
(solid, from **isocyanate-contg. siloxane-crosslinked**
polyoxyethylene lithium complex networks, prepn. and cond. of)
IT 7791-03-9DP, Lithium perchlorate, complexes with
isocyanate-contg. siloxane-crosslinked polyoxyethylenes
33454-82-9DP, Lithium triflate, complexes with
isocyanate-contg. siloxane-crosslinked polyoxyethylenes
138855-09-1DP, lithium complexes
RL: **SPN (Synthetic preparation); PREP (Preparation)**
(networks, solid electrolytes from, prepn. and cond. of)
IT 7791-03-9DP, Lithium perchlorate, complexes with
isocyanate-contg. siloxane-crosslinked polyoxyethylenes
33454-82-9DP, Lithium triflate, complexes with
isocyanate-contg. siloxane-crosslinked polyoxyethylenes
RL: **SPN (Synthetic preparation); PREP (Preparation)**
(networks, solid electrolytes from, prepn. and cond. of)
RN 7791-03-9 HCPLUS
CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



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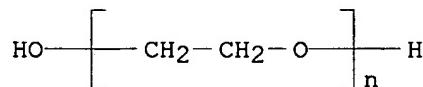
RN 33454-82-9 HCPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 32 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1991:619912 HCPLUS
 DN 115:219912
 TI Synthesis and conducting properties of solid **polymer electrolytes** of **lithium** salts and polyethylene glycols **crosslinked** with a siloxane-based **tetraisocyanate**
 AU Xia, Du Wei; Smid, Johannes
 CS Coll. Environ. Sci. For., State Univ. New York, Syracuse, NY, 13210, USA
 SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (1991), 32(1), 168-9
 CODEN: ACPPAY; ISSN: 0032-3934
 DT Journal
 LA English
 CC 76-2 (Electric Phenomena)
 Section cross-reference(s): 35, 38
 AB The synthesis and conducting properties of LiClO₄ and CF₃SO₃Li-contg. networks of polyethylene glycols are reported. A siloxane-based aliph. **isocyanate** was the **crosslinking** agent of choice. In a no. of systems polyethylene glycols with terminal amino groups ("Jeffamines") were used. With propylene carbonate added, conductivities close to 10⁻² cm⁻¹ at 90.degree. were recorded.
 ST **polymer electrolyte lithium salt;**
polyethylene glycol crosslinking siloxane isocyanate
 IT Siloxanes and Silicones, uses and miscellaneous
 RL: PREP (**Preparation**)
 (lithium salt electrolytes, prepn. of)
 IT Electric conductors
 (lithium salts of poly(ethylene glycol) **crosslinked** with siloxanes)

- IT Electric conductivity and conduction
 Glass temperature and transition
 (of lithium salt poly(ethylene glycol) **crosslinked**
 with siloxane)
- IT Polymerization
 (of poly(ethylene glycol) with siloxane-based **tetraisocyanate**
 in conductor prepn.)
- IT 563-79-1, Tetramethylethylene 35147-35-4, Dibutyldilauryltin
 RL: CAT (Catalyst use); USES (Uses)
 (catalyst, for polymn. of siloxane-based **tetraisocyanate** with
polyethylene glycol)
- IT 25322-68-3, Polyethyleneglycol
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (**crosslinking** of, with siloxane for conductor prepn.)
- IT 70939-81-0
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (**crosslinking** of, with **tetraisocyanate** in
 conducting polymer prepn.)
- IT 2094-99-7
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (hydrosilylation of, in conducting polymer prepn.)
- IT 2370-88-9, Tetramethylcyclotetrasiloxane
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (hydrosilylation of, with .alpha.,.alpha.-dimethyl-m-isopropenylbenzyl
isocyanate)
- IT 7439-93-2D, Lithium, salts
 RL: USES (Uses)
 (in conductor polymer prepn.)
- IT 70939-81-0D, tetracyclosiloxane complex with
 RL: USES (Uses)
 (in lithium salt **crosslinked polyethylene**
glycol siloxane-based **tetraisocyanate** polymer prepn.)
- IT 124219-73-4P
 RL: RCT (Reactant); PREP (Preparation); RACT (Reactant or
 reagent)
 (prepn. and polymn. of, for polymeric conductor prepn.)
- IT 124219-73-4DP, poly(ethylene oxide) diether complex with
 RL: PREP (Preparation)
 (prepn. of conductor of)
- IT 25322-68-3, Polyethyleneglycol
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (**crosslinking** of, with siloxane for conductor prepn.)
- RN 25322-68-3 HCPLUS
- CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX
 NAME)



- IT 7439-93-2D, Lithium, salts
 RL: USES (Uses)
 (in conductor polymer prepn.)
- RN 7439-93-2 HCPLUS
- CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 33 OF 44 HCAPLUS COPYRIGHT 2003 ACS

AN 1991:572418 HCAPLUS

DN 115:172418

TI Solid **electrolyte** comprising **urethane-**
crosslinked acrylic polymer

IN Ido, Shuichi; Imachi, Hiroshi; Noda, Tomohiko

PA Yuasa Battery Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 3 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM H01B001-12

ICS C08F299-00; H01M006-18; H01M010-40

CC 76-2 (Electric Phenomena)

Section cross-reference(s): 38

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 03084807	A2	19910410	JP 1989-220783	19890828
PRAI JP 1989-220783		19890828		

AB The title **electrolyte**, contg. an ionic salt and a compd. which dissolves the salt, comprises a **crosslinked acryloyl compd. polymer** network having a **urethane** part. The electrolyte is useful for electrochem. devices, e.g. a **battery**, an electrochromic display, a sensor, an elec. capacitor, etc. Thus, a soln. contg. 2-hydroxyethanol-**diisocyanate** copolymer diacrylate, poly(ethylene oxide) diacrylate, Li trifluoromethanesulfonate, benzophenone, and propylene carbonate was cast on a glass plate and UV-irradiated to give an ion-conductive film showing bending strength.

ST solid **polymer electrolyte** acrylic **polyurethane**
; **polyethylene oxide** acrylate copolymer
crosslinking; **polyoxyalkylene polyurethane**
acrylic electrolyte; ionic salt doped **polymer**
electrolyte; lithium fluoromethanesulfonate doped
polymer electrolyte; propylene carbonate doped solid
electrolyte; bending strength network **crosslinked electrolyte**

IT Polyelectrolytes
(**urethane-crosslinked acrylic**, ionic salt-doped,
with bending strength)

IT **Urethane polymers**, uses and miscellaneous
RL: TEM (Technical or engineered material use); USES (Uses)
(**acrylic-polyoxyalkylene-**, **crosslinked**, ionic
salt-doped, **electrolyte**, with bending strength)

IT **Polyoxyalkylenes**, uses and miscellaneous
RL: TEM (Technical or engineered material use); USES (Uses)
(**acrylic-polyurethane-**, **crosslinked**, ionic
salt-doped, electrolyte, with bending strength)

IT Acrylic **polymers**, uses and miscellaneous
RL: TEM (Technical or engineered material use); USES (Uses)
(**polyoxyalkylene-polyurethane-**, **crosslinked**,
ionic salt-doped, **electrolyte**, with bending strength)

IT **33454-82-9**, **Lithium trifluoromethanesulfonate**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or

engineered material use); PROC (Process); USES (Uses)
 (dopant, for **urethane-crosslinked acrylic polymer**, for **electrolyte**, with bending strength)

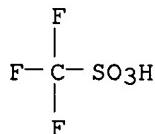
IT 26570-48-9DP, reaction products with **isocyanate acrylates**
 RL: **PREP (Preparation)**
 (prepn. of, ionic salt-doped, electrolyte, with bending strength)

IT 108-32-7, Propylene carbonate
 RL: TEM (Technical or engineered material use); USES (Uses)
 (solvent, for ionic salt, for acrylic **polyurethane electrolyte**)

IT 33454-82-9, Lithium trifluoromethanesulfonate
 RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
 (dopant, for **urethane-crosslinked acrylic polymer**, for **electrolyte**, with bending strength)

RN 33454-82-9 HCPLUS

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 34 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1991:250699 HCPLUS
 DN 114:250699
 TI Ion-conductive **polymer electrolyte**
 IN Motogami, Kenji; Mori, Shigeo
 PA Daiichi Kogyo Seiyaku Co., Ltd., Japan
 SO Eur. Pat. Appl., 18 pp.
 CODEN: EPXXDW
 DT Patent
 LA English
 IC ICM H01M006-18
 ICS H01B001-12
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 74, 76

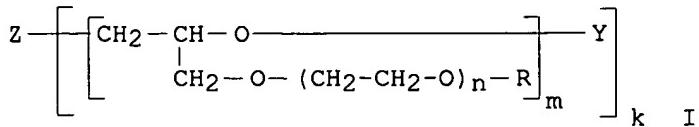
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	EP 392839	A2	19901017	EP 1990-303944	19900411
	EP 392839	A3	19911127		
	EP 392839	B1	19950712		
	R: DE, FR, GB, NL				
	JP 03047833	A2	19910228	JP 1990-32237	19900213
	JP 2762145	B2	19980604		
	JP 03200863	A2	19910902	JP 1990-59132	19900309
	US 5116541	A	19920526	US 1990-507143	19900410
	CA 2014442	AA	19901013	CA 1990-2014442	19900411
PRAI	JP 1989-93763		19890413		

JP 1989-280723

19891026

GI



- AB The **electrolyte** comprises a **polymer** and a sol. salt, where the **polymer** is obtained by **crosslinking** a compd. I having an av. mol. wt. 1000-20,000 with an **isocyanate** compd. or by itself, where Z is a residue of a compd. having .gtoreq.1 active H, Y is H or **polymerizable** functional group, m = 1-250, n .ltoeq.25, k = 1-12, and R is a C1-20 alkyl, alkenyl, aryl, or alkylaryl.;. The electrolyte salt is selected from Li, Na, K, Cs, Ag, Cu, and/or Mg inorg. or org. salts. The electrolyte is suitable for various applications such as in **batteries**, electrochromic devices, etc. The ionic cond. of the invention electrolyte is excellent and its superiority becomes remarkable at low temps.
- ST ion conductive **polymer electrolyte**; **battery**
polymer electrolyte; electrochromic device
polymer electrolyte; cond ionic **polymer**
electrolyte
- IT Batteries, primary
 Batteries, secondary
 (**polymer electrolytes** for, ion-conductive)
- IT Optical imaging devices
 (electrochromic, **polymer electrolytes** for,
 ion-conductive)
- IT Electric conductivity and conduction
 (ionic, of **polymer electrolytes**, for
batteries and electrochromic devices)
- IT 7439-93-2D, Lithium, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7439-95-4D, Magnesium, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7440-09-7D, Potassium, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7440-22-4D, Silver, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7440-23-5D, Sodium, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7440-46-2D, Cesium, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 7440-50-8D, Copper, complexes with
polyoxyalkylene-polyurethane or **polyoxyalkylene**
 -acrylic copolymers 134196-41-1D, complexes with alkali or alk. earth metals 134196-42-2D, complexes with alkali or alk. earth metals 134196-43-3D, complexes with alkali or alk. earth metals 134196-44-4D, complexes with alkali or alk. earth metals 134196-45-5D, complexes with alkali or alk. earth metals 134196-46-6D, complexes with alkali or alk. earth metals 134196-47-7D, complexes with alkali or alk. earth metals 134196-48-8D, complexes with alkali or alk. earth metals 134196-49-9D, complexes with alkali or alk. earth metals 134196-50-2D, complexes with

alkali or alk. earth metals 134247-92-0D, complexes with alkali or alk. earth metals 134247-93-1D, complexes with alkali or alk. earth metals 134247-94-2D, complexes with alkali or alk. earth metals 134247-95-3D, complexes with alkali or alk. earth metals 134247-96-4D, complexes with alkali or alk. earth metals
 RL: DEV (Device component use); USES (Uses)
 (electrolytes, for batteries and electrochromic devices)

IT 7439-93-2D, Lithium, complexes with polyoxyalkylene-polyurethane or polyoxyalkylene-acrylic copolymers
 RL: DEV (Device component use); USES (Uses)
 (electrolytes, for batteries and electrochromic devices)

RN 7439-93-2 HCAPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 35 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1991:65835 HCAPLUS
 DN 114:65835
 TI Ionic conductive polymer electrolyte and lithium batteries using the electrolyte
 IN Shakushiro, Kyoaki; Nagai, Ryo; Kawakami, Akira
 PA Hitachi Maxell, Ltd., Japan
 SO Eur. Pat. Appl., 13 pp.
 CODEN: EPXXDW
 DT Patent
 LA English
 IC ICM H01M006-18
 ICS H01B001-12
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 74, 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	EP 378123	A1	19900718	EP 1990-100195	19900105
	EP 378123	B1	19960911		
	R: DE, GB				
	JP 02291603	A2	19901203	JP 1989-343598	19891229
	US 5227043	A	19930713	US 1990-460252	19900102

PRAI JP 1989-1767

19890107

JP 1989-1768

19890107

AB The electrolyte comprises a crosslinked Si-contg. polymer and an alkali metal salt and has an ionic cond. of .gtoreq.10⁻⁵ s/cm at 25.degree.. The polymer comprises .gtoreq.20 wt.% alkylene oxide (ethylene oxide) units, and the Si atom in the polymer is present as SiCH₂CHR(CH₂)_p, SiOCHRCH₂, SiCH₂CHRCO, or SiOSiO, where R is H or Me and p is 0 or 1. The polymer has a crystallinity .ltoreq.30% or is amorphous, has a glass transition temp. .ltoreq.-40.degree., and dynamic loss modulus .ltoreq.10⁹ dyne/cm² at 25.degree.. Batteries using this electrolyte have Li or Li alloy anodes, and cathodes selected from chalcogenides, V oxides, Co oxides, Mn oxides, and conductive polymers. The electrolyte can also be used in electrochromic display devices and in Li⁺ sensors.

ST lithium battery polymer electrolyte

; **polyoxyalkylene silylalkyl ether battery**
electrolyte; cond **polyoxyalkylene silylalkyl ether electrolyte**

IT **Batteries, primary**
 Batteries, secondary
 (lithium, **electrolytes** of alkali metal salt-contg.
 crosslinked silicon-contg. polymers for)

IT Electric conductivity and conduction
 (of lithium fluoroborate-contg. **crosslinked**
 silicon-contg. **polymer electrolytes**, for
 batteries and electrochromic display devices)

IT Optical imaging devices
 (electrochromic, **electrolytes** of alkali metal salt-contg.
 crosslinked silicon-contg. polymers for)

IT **Polyoxyalkylenes, compounds**
RL: USES (Uses)
 (ethers, silylalkyl, **polymers, electrolytes**, for
 batteries and electrochromic display devices)

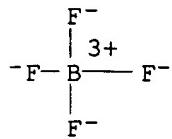
IT 14283-07-9
RL: USES (Uses)
 (**electrolytes** contg. **crosslinked polymers**
 of **polyoxyalkylenes** silylalkyl ethers and, for
 batteries and electrochromic display devices)

IT 111-34-2D, Butyl vinyl ether, reaction products with **polyethylene**
glycol silylalkyl ethers, **polymers**, lithium
complexes 694-53-1D, Phenylsilane, reaction products with
polyethylene glycol allyl ethers, vinyl derivs.,
polymers, lithium complexes 814-74-4D,
1,1,2-Trimethyldisilane, reaction products with **polyethylene**
glycol allyl ethers, vinyl derivs., **polymers**,
lithium complexes 822-06-0D, reaction products with
polyethylene glycol silylalkyl ethers, **polymers**
, lithium complexes 871-92-1D, reaction products with
polyethylene glycol allyl ethers, vinyl derivs.,
polymers, lithium complexes 2370-88-9D,
Tetramethylcyclotetrasiloxane, reaction products with **polyethylene**
glycol allyl ethers, vinyl derivs., **polymers**,
lithium complexes 4459-30-7D, reaction products with
polyethylene glycol allyl ethers, vinyl derivs.,
polymers, lithium complexes 7439-93-2D,
Lithium, complexes with **crosslinked polymers**
of **polyoxyalkylenes** silylalkyl ethers 17082-46-1D, reaction
products with **polyethylene glycol** allyl ethers, vinyl
derivs., **polymers**, lithium complexes 27274-31-3D,
Polyethylene glycol allyl ether, reaction products with
silanes, vinyl derivs., **polymers**, lithium complexes
131923-63-2D, reaction products with **polyethylene glycol**
allyl ethers, vinyl derivs., **polymers**, lithium
complexes
RL: USES (Uses)
 (**electrolytes**, for **batteries** and electrochromic
 display devices)

IT 14283-07-9
RL: USES (Uses)
 (**electrolytes** contg. **crosslinked polymers**
 of **polyoxyalkylenes** silylalkyl ethers and, for
 batteries and electrochromic display devices)

RN 14283-07-9 HCAPLUS

CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

 Li^+

IT 822-06-0D, reaction products with **polyethylene glycol silylalkyl ethers, polymers, lithium complexes 7439-93-2D, Lithium, complexes with crosslinked polymers of polyoxyalkylenes silylalkyl ethers**
 RL: USES (Uses)
 (electrolytes, for batteries and electrochromic display devices)
 RN 822-06-0 HCPLUS
 CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

OCN—(CH₂)₆—NCO

RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 36 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1990:615312 HCPLUS
 DN 113:215312
 TI **Polymer solid electrolytes**
 IN Yoneyama, Sachiko; Osawa, Toshuki; Kimura, Okitoshi; Kahata, Toshiyuki
 PA Ricoh Co., Ltd., Japan
 SO Jpn. Kokai Tokkyo Koho, 6 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01M010-40
 ICS G02F001-15; H01G009-02
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 74, 76
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 02005370	A2	19900110	JP 1988-141585	19880610
	JP 2941812	B2	19990830		
PRAI	JP 1987-301587		19871201		
AB	The electrolytes have a matrix of crosslinked PEO having A1280/A842 ratio .ltoreq.0.80, where A1280 and A840 are the				

absorptance of the **polymer** at 1280/cm and 842/cm of its IR spectrum, resp. The electrolytes have high ionic cond. and mech. strength, and are useful for secondary **batteries**, electrochromic devices, and capacitors.

ST PEO **crosslinked** solid electrolyte matrix; **battery**
 electrolyte **crosslinked** PEO matrix; electrochromic device
 electrolyte **crosslinked** PEO; capacitor electrolyte
crosslinked PEO matrix

IT **Batteries**, secondary
 Electric capacitors
 (solid electrolytes with **crosslinked** PEO matrixes for)

IT Optical imaging devices
 (electrochromic, solid electrolytes with **crosslinked** PEO matrixes for)

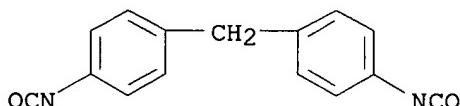
IT 101-68-8D, **polymers** with **polyoxyethylene**
 triols, lithium complexes 614-90-4D, **polymers** with
polyoxyethylene triols, lithium complexes
 822-06-0D, **polymers** with **polyoxyethylene**
 triols, lithium complexes 2422-91-5D, **polymers** with
polyoxyethylene triols, lithium complexes 2761-22-0D,
polymers with **polyoxyethylene** triols, lithium
 complexes 4747-90-4D, **polymers** with **polyoxyethylene**
 triols, lithium complexes 25322-68-3D, triol ethers,
polymers with **isocyanates**, lithium complexes
 RL: USES (Uses)
 (electrolytes, for **batteries** and electrochromic
 devices and capacitors)

IT 7791-03-9, Lithium perchlorate 14283-07-9,
 Lithium tetrafluoroborate 33454-82-9, Lithium
 trifluoromethanesulfonate
 RL: USES (Uses)
 (electrolytes, in **crosslinked** PEO matrixes, for
batteries and electrochromic devices and capacitors)

IT 101-68-8D, **polymers** with **polyoxyethylene**
 triols, lithium complexes 822-06-0D, **polymers**
 with **polyoxyethylene** triols, lithium complexes
 25322-68-3D, triol ethers, **polymers** with
isocyanates, lithium complexes
 RL: USES (Uses)
 (electrolytes, for **batteries** and electrochromic
 devices and capacitors)

RN 101-68-8 HCPLUS

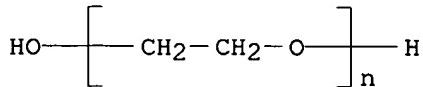
CN Benzene, 1,1'-methylenebis[4-isocyanato- (9CI) (CA INDEX NAME)



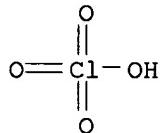
RN 822-06-0 HCPLUS
 CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

OCN- (CH₂)₆- NCO

RN 25322-68-3 HCPLUS
CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)

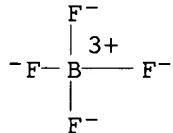


IT 7791-03-9, Lithium perchlorate 14283-07-9,
Lithium tetrafluoroborate 33454-82-9, Lithium
trifluoromethanesulfonate
RL: USES (Uses)
(electrolytes, in crosslinked PEO matrixes, for
batteries and electrochromic devices and capacitors)
RN 7791-03-9 HCPLUS
CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



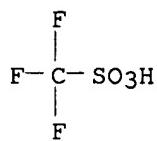
Li

RN 14283-07-9 HCPLUS
CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)



Li⁺

RN 33454-82-9 HCPLUS
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 37 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1990:182903 HCAPLUS
 DN 112:182903
 TI Secondary batteries and electrochromic display devices
 IN Yoneyama, Sachiko; Ohsawa, Toshiyuki; Kimura, Okitoshi; Kabata, Toshiyuki
 PA Ricoh Co., Ltd., Japan
 SO Ger. Offen., 12 pp.
 CODEN: GWXXBX
 DT Patent
 LA German
 IC ICM H01M006-12
 ICS H01M006-18; H01M010-38; G02F001-17; H01G009-02
 ICA C03C003-00; C04B035-10; C04B035-46; C08L023-06; C08L025-02; C08L033-12;
 C08L071-02; C08L077-00
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 37, 38, 57, 74
 FAN.CNT 1

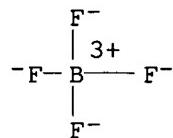
	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 3920129	A1	19891228	DE 1989-3920129	19890620
	DE 3920129	C2	19910221		
	JP 01319268	A2	19891225	JP 1988-151110	19880621
	US 5011751	A	19910430	US 1989-369122	19890621
	JP 02155173	A2	19900614	JP 1989-204582	19890809
	JP 3062203	B2	20000710		
PRAI	JP 1988-151110	A	19880621		
	JP 1988-197173	A	19880809		
OS	MARPAT 112:182903				
AB	Batteries and electrochromic display devices have .gtoreq.1 pair of electrodes sandwiching a solid polymeric electrolyte. The electrolyte contains a salt and .apprx.0.1-50 vol.% dispersed spherical ion-conductive particles of uniform size (diam. 0.1-50 .mu.m) and having an electron cond. of .ltoreq.10-10 S/cm. The particles are made of polymers such as phenolic resins, crosslinked poly(divinylbenzene), poly(Me methacrylate, polystyrene, etc., or of inorg. materials such as crown glass, Nasicon, Lisicon, Al2O3, and TiO2. The electrolyte salt contains BR4- anions, where R is alkyl, Ph, or halogen.				
ST	battery secondary polymer electrolyte; electrochromic device polymer electrolyte; haloborate polymer electrolyte battery; alkylborate polymer electrolyte battery; phenylborate polymer electrolyte battery; polymer haloborate electrolyte battery; oxide dispersion polymer electrolyte battery; glass dispersion				

- polymer electrolyte battery**
- IT Optical imaging devices
 (electrochromic, solid **polymer electrolytes** for,
 dispersed spherical particles- and salt-contg.)
- IT **Batteries, secondary**
 (solid-electrolyte, **polymer electrolytes**
 for, dispersed spherical particles- and salt-contg.)
- IT **7439-93-2, Lithium, uses and miscellaneous**
 RL: USES (Uses)
 (anodes, in **batteries** with **polymer**
 electrolytes)
- IT 12039-13-3, Titanium sulfide (TiS₂) 25233-30-1 30604-81-0
 RL: USES (Uses)
 (cathodes, in **batteries** with **polymer**
 electrolytes)
- IT 7440-57-5, Gold, uses and miscellaneous 50926-11-9, Indium tin oxide
 84928-92-7
 RL: USES (Uses)
 (electrodes, in electrochromic devices with **polymer**
 electrolytes)
- IT 26570-48-9 126465-26-7, Micropearl SP 205
 RL: USES (Uses)
 (**electrolytes** contg. dispersed particles of, **polymer**
 , for **batteries**)
- IT 1344-28-1, Aluminum oxide (Al₂O₃), uses and miscellaneous 13463-67-7,
 Titanium oxide (TiO₂), uses and miscellaneous 70780-99-3 77641-62-4,
 Nasicon
 RL: USES (Uses)
 (**electrolytes** contg. dispersed particles of, **polymer**
 , for **batteries** and electrochromic devices)
- IT 126465-27-8, Micropearl SP 214
 RL: USES (Uses)
 (**electrolytes** contg. dispersed particles of, **polymer**
 , for electrochromic devices)
- IT 7778-74-7 **14283-07-9** 14485-20-2
 RL: USES (Uses)
 (**electrolytes** contg. **polymers** and, dispersed
 polymer andceramic particles in, for **batteries** and
 electrochromic devices)
- IT **584-84-9D, polymers with polyoxyethylene**
 triols, lithium complexes **25322-68-3D**, triol derivs.,
 polymers with TDI, lithium complexes
 RL: USES (Uses)
 (**electrolytes**, contg. ceramic particles and propylene
 carbonate and tetrafluoroborate, for **batteries**)
- IT **7439-93-2D, Lithium, polymer complexes**
 7440-09-7D, Potassium, **polymercomplexes**
 RL: USES (Uses)
 (**electrolytes**, contg. ceramic particles, for
 batteries)
- IT 24937-79-9D, Poly(vinylidene fluoride), **lithium** and potassium
 complexes
 RL: USES (Uses)
 (**electrolytes**, contg. dispersed divinylbenzene copolymer particles, for
 batteries and electrochromic devices)
- IT **7439-93-2, Lithium, uses and miscellaneous**
 RL: USES (Uses)
 (anodes, in **batteries** with **polymer**)

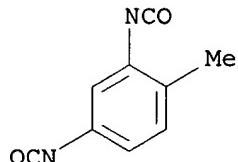
electrolytes)
 RN 7439-93-2 HCAPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

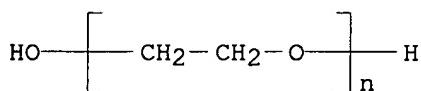
IT 14283-07-9
 RL: USES (Uses)
 (electrolytes contg. polymers and, dispersed
 polymer and ceramic particles in, for batteries and
 electrochromic devices)
 RN 14283-07-9 HCAPLUS
 CN Borate(1-), tetrafluoro-, lithium (8CI, 9CI) (CA INDEX NAME)

 Li^+

IT 584-84-9D, polymers with polyoxyethylene
 triols, lithium complexes 25322-68-3D, triol derivs.,
 polymers with TDI, lithium complexes
 RL: USES (Uses)
 (electrolytes, contg. ceramic particles and propylene
 carbonate and tetrafluoroborate, for batteries)
 RN 584-84-9 HCAPLUS
 CN Benzene, 2,4-diisocyanato-1-methyl- (9CI) (CA INDEX NAME)



RN 25322-68-3 HCAPLUS
 CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX
 NAME)



IT 7439-93-2D, Lithium, polymer complexes
 RL: USES (Uses)

(electrolytes, contg. ceramic particles, for batteries)

RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

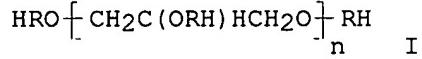
Li

L21 ANSWER 38 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1989:646065 HCPLUS
 DN 111:246065
 TI Lithium ion conductive polymer electrolytes
 IN Akashiro, Kyoaki; Nagai, Tatsu; Manabe, Toshikatsu
 PA Hitachi Maxell, Ltd., Japan
 SO Jpn. Kokai Tokkyo Koho, 7 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01M010-40
 ICS H01M006-18
 CC 76-2 (Electric Phenomena)
 Section cross-reference(s): 35, 52

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 01107473	A2	19890425	JP 1987-265810	19871020
PRAI JP 1987-265810		19871020		

GI



AB In a Li ion conductive polymer electrolyte comprising a Li salt and an org. polymer, the org. polymer is an adduct I of polyglycerin and poly(ether glycol) (R = polyethylene glycol, polypropylene glycol, ethylene oxide-propylene oxide copolymer; n < 10 req. 50) and optionally crosslinked with a crosslinking agent. The electrolyte has high Li ion cond. and is in solid phase at room temp., and useful for Li batteries, electrochromic display devices, Li ion sensors, Li ion sepn. membranes, etc. A soln. mixt. contg. Unigly AV 645 [polyglycerin-poly(ether glycol) adduct] and 2,4-tolylene diisocyanate was dropwise spread on an Al substrate, reacted at 80.degree. for 8 h in Ar flow to give a block copolymer, which was immersed in LiCF3SO3-contg. acetone to impregnate LiCF3SO3 in the block copolymer and give an electrolyte having high ion cond.

ST lithium ion conductor polymer electrolyte; battery electrolyte ion conductor polymer; polyglycerin alkylene oxide adduct electrolyte

IT Batteries, primary
 Electric conductors
 (lithium ion conductive polymer)

electrolytes for)

IT **Electrolytes**
 (lithium ion conductive **polymers** for)

IT Optical imaging devices
 (electrochromic, lithium ion conductive **polymer electrolytes** for)

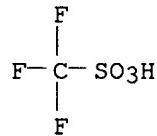
IT 88651-88-1 124036-74-4
 RL: DEV (Device component use); USES (Uses)
 /ion conductive electrolyte of, doped with **lithium salt**, for **batteries** and electrochromic display devices)

IT **33454-82-9**
 RL: DEV (Device component use); USES (Uses)
 (**polymer electrolyte** doped with, for **lithium** ion cond., for **batteries** and electrochromic display devices)

IT **33454-82-9**
 RL: DEV (Device component use); USES (Uses)
 (**polymer electrolyte** doped with, for **lithium** ion cond., for **batteries** and electrochromic display devices)

RN 33454-82-9 HCAPLUS

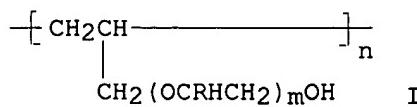
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



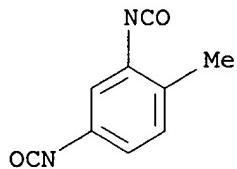
Li

L21 ANSWER 39 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1989:607398 HCAPLUS
 DN 111:207398
 TI **Lithium ion conductive polymer electrolytes**
 IN Akashiro, Kyoaki; Nagai, Tatsu; Manabe, Toshikatsu
 PA Hitachi Maxell, Ltd., Japan
 SO Jpn. Kokai Tokkyo Koho, 7 pp.
 CODEN: JKXXAF
 DT Patent
 LA Japanese
 IC ICM H01M010-40
 ICS H01M006-18
 CC 76-2 (Electric Phenomena)
 Section cross-reference(s): 35, 52
 FAN.CNT 1

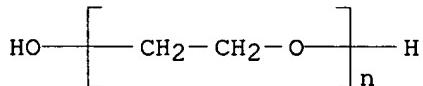
PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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PI JP 01107474	A2	19890425	JP 1987-265811	19871020
PRAI JP 1987-265811		19871020		
GI				



- AB In a **Li** ion conductive **polymer electrolyte** comprising a **Li** salt and an org. **polymer**, the org. **polymer** is a vinyl **polymd.** allylated polyether glycol I (R = H, Me; m = 3-360; n = 2-40) optionally **crosslinked** with a **crosslinking** agent. The electrolyte has high **Li** ion cond. at room temp. and is useful for **Li batteries**, electrochromic display devices, **Li** ion sensors, **Li** ion sepn. membranes, etc. A sticky soln. mixt. contg. polyallylated poly(ethylene glycol), which was prep'd. by reaction of allylated poly(ethylene glycol) with azobisisobutyronitrile, and 2,4-tolylene **diisocyanate** was dropwise spread on an Al substrate, and reacted at 80.degree. for 8 h in Ar flow to give a block copolymer, which was immersed in LiCF3SO3-contg. acetone to impregnate LiCF3SO3 in the block copolymer and give an electrolyte having high ion cond.
- ST lithium ion conductor **polymer electrolyte**; **battery electrolyte** ion conductor **polymer**; allylated **polyethylene glycol** block copolymer
- IT **Batteries**, primary
Electric conductors
(lithium ion conductive **polymer**
electrolytes for)
- IT **Electrolytes**
(lithium ion conductive **polymers** for)
- IT Optical imaging devices
(electrochromic, lithium ion conductive **polymer**
electrolytes for)
- IT **Urethane polymers**, uses and miscellaneous
RL: DEV (Device component use); USES (Uses)
(**polyoxalkylene**-, ion conductive **electrolyte** of,
doped with **lithium** salt, for **batteries** and
electrochromic display devices)
- IT 584-84-9D, reaction products with polyallylated poly(ethylene glycol) 25322-68-3D, Poly(ethylene glycol), polyallylated, reaction products with 2,4-tolylene **diisocyanate**
RL: DEV (Device component use); USES (Uses)
(ion conductive electrolyte of, doped with **lithium** salt, for
batteries and electrochromic display devices)
- IT 123524-39-0
RL: DEV (Device component use); USES (Uses)
(**polymer electrolyte** doped with, for
lithium ion cond., for **batteries** and electrochromic
display devices)
- IT 584-84-9D, reaction products with polyallylated poly(ethylene glycol) 25322-68-3D, Poly(ethylene glycol), polyallylated, reaction products with 2,4-tolylene **diisocyanate**
RL: DEV (Device component use); USES (Uses)
(ion conductive electrolyte of, doped with **lithium** salt, for
batteries and electrochromic display devices)
- RN 584-84-9 HCPLUS
- CN Benzene, 2,4-diisocyanato-1-methyl- (9CI) (CA INDEX NAME)



RN 25322-68-3 HCAPLUS
 CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



L21 ANSWER 40 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1989:557409 HCAPLUS
 DN 111:157409
 TI Radiation-cured solid electrolytes and batteries using these electrolytes
 IN Lee, Mei Tsu; Shackle, Dale R.; Schwab, Gerhart
 PA MHB Joint Venture, USA
 SO U.S., 9 pp. Cont.-in-part of U.S. Ser. No. 115,492, abandoned.
 CODEN: USXXAM
 DT Patent
 LA English
 IC ICM H01M006-18
 NCL 429192000
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 76

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 4830939	A	19890516	US 1988-173385	19880325
	US 4830939	B1	19961008		
	JP 02000602	A2	19900105	JP 1988-270628	19881026
	DK 8806020	A	19890501	DK 1988-6020	19881028
	CN 1033126	A	19890524	CN 1988-107375	19881028
	CN 1039953	B	19980923		
	EP 318161	A1	19890531	EP 1988-310179	19881028
	EP 318161	B1	19941214		
	R: BE, DE, FR, GB, IT, NL, SE				
	EP 606117	A2	19940713	EP 1994-104165	19881028
	EP 606117	A3	19960612		
	EP 606117	B1	20011219		
	R: BE, DE, FR, GB, IT, NL, SE				
	CA 1339619	A1	19980106	CA 1988-581609	19881028
	US 5037712	A	19910806	US 1990-506408	19900406
	EP 450981	A1	19911009	EP 1991-303034	19910405
	EP 450981	B1	19950621		
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE				
	JP 05109310	A2	19930430	JP 1991-73149	19910405
	JP 2572897	B2	19970116		

ES 2075346	T3	19951001	ES 1991-303034	19910405
CA 2039836	AA	19911007	CA 1991-2039836	19910408
US 5238758	A	19930824	US 1991-776722	19911015

PRAI US 1987-115492 A2 19871030
 US 1988-173385 A 19880325
 EP 1988-310179 A3 19881028
 US 1989-326574 B2 19890321
 US 1990-506408 A 19900406
 US 1990-549658 B1 19900709

AB A mixt. of a liq. monomeric or prepolymeric radiation polymerizable ethylenically unsatd. compd., a radiation-inert ionically conducting liq. (an aprotic polar solvent), and an ionizable alkali metal salt is subjected to an actinic (UV or electron-beam) radiation to crosslink the polymerizable material to form a solid electrolyte matrix for use in batteries. The polymerizable compd. is A[CH₂C(R)(H)O]_nA, A[CH₂CH₂N(R)]_nA, or A[CH₂N(R)CH₂]_nA, where n is .apprx. 3-50, R is H or C₁-3 alkyl group, and A is an ethylenically unsatd. or a glycidyl moiety. The compd. is polyethylene glycol diacrylate, polyethylene glycol dimethacrylate, an acrylate functionalized polyurethane, or polyethylene glycol diglycidyl ether. The ionically conducting liq. is present in the mixt. at .gtoreq. 45 wt.% and is polyethylene glycol di-Me ether or an aprotic polar solvent selected from propylene carbonate, .gamma.-butyrolactone, 1,3-dioxolane, and 2-methyltetrahydrofuran. The anion of the salt is selected from I-, Br-, SCN-, ClO₄-, CF₃SO₃-, BF₄-, PF₆-, AsF₆-, and CF₃CO₂-. Methods for forming anodes (Li), cathodes (intercalation compd. such as V oxide), and batteries using this polymeric network are also disclosed.

ST battery electrolyte polymer aprotic solvent; polyethylene glycol diacrylate battery electrolyte; ether dimethyl polyethylene glycol electrolyte; alkali metal salt polymer electrolyte; lithium polymer electrolyte battery anode; vanadium oxide polymer electrolyte cathode; electron beam radiation polymer electrolyte

IT Electron beam, chemical and physical effects (in manuf. of electrolytes contg. aprotic polar solvents and polymers, for batteries)

IT Batteries, secondary (lithium-vanadium oxide, with polymer-contg. electrolytes, manuf. of)

IT Electric conductivity and conduction (ionic, of lithium salt-polymer-aprotic polar solvent electrolytes)

IT Alkali metals, compounds
 RL: USES (Uses)
 (salts, polymer complexes, electrolytes contg. aprotic polar solvents, for batteries and battery electrodes)

IT 7439-93-2P, Lithium, uses and miscellaneous
 RL: PREP (Preparation); USES (Uses)
 (anodes, contg. electrolytes, manuf. of, for batteries)

IT 12037-42-2P, Vanadium oxide (V6O13)
 RL: PREP (Preparation)
 (cathodes, contg. electrolytes, manuf. of, for batteries)

IT 96-47-9, 2-Methyltetrahydrofuran 96-48-0 108-32-7, Propylene carbonate
 646-06-0, 1,3-Dioxolane 24991-55-7, Polyethylene

glycol dimethyl ether
 RL: USES (Uses)
 (electrolytes contg. lithium salt and polymer and, for batteries and battery electrodes)

IT 33454-82-9, Lithium trifluoromethanesulfonate
 RL: USES (Uses)
 (electrolytes contg. polymers and polyethylene glycol di-Me ether and, for batteries and battery electrodes)

IT 25852-47-5D, alkali metal complexes 26403-72-5D, Polyethylene glycol diglycidyl ether, alkali metal complexes
 RL: USES (Uses)
 (electrolytes, contg. aprotic polar solvent, for batteries and battery electrodes)

IT 7439-93-2D, Lithium, polymer complexes
 26570-48-9D, Polyethylene glycol diacrylate,
 lithium complexes 122985-87-9D, Uvithane ZL 1178,
 lithium complexes 122988-77-6D, lithium complexes
 RL: USES (Uses)
 (electrolytes, contg. polyethylene glycol di-Me ether, for batteries and battery electrodes)

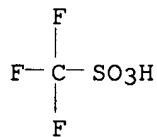
IT 7439-93-2P, Lithium, uses and miscellaneous
 RL: PREP (Preparation); USES (Uses)
 (anodes, contg. electrolytes, manuf. of, for batteries)

RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IT 33454-82-9, Lithium trifluoromethanesulfonate
 RL: USES (Uses)
 (electrolytes contg. polymers and polyethylene glycol di-Me ether and, for batteries and battery electrodes)

RN 33454-82-9 HCPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

IT 7439-93-2D, Lithium, polymer complexes
 RL: USES (Uses)
 (electrolytes, contg. polyethylene glycol di-Me ether, for batteries and battery electrodes)

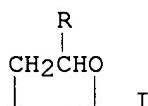
RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

L21 ANSWER 41 OF 44 HCPLUS COPYRIGHT 2003 ACS
 AN 1989:118336 HCPLUS
 DN 110:118336
 TI Novel macromolecular material for electrolytes and/or electrodes
 IN Armand, Michel; Muller, Daniel; Duval, Michel; Harvey, Paul E.; Chabagno, Jean M.
 PA Societe Nationale Elf Aquitaine (SNEA), Fr.; Hydro-Quebec
 SO U.S., 5 pp. Cont.-in-part of U.S. 4,478,326.
 CODEN: USXXAM
 DT Patent
 LA English
 IC ICM H01M006-18
 ICS H01M010-40
 NCL 429192000
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 76
 FAN.CNT 2

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 4758483	A	19880719	US 1985-774915	19850911
US 4578326	A	19860325	US 1984-584535	19840228
PRAI US 1984-584535		19840228		
ID 1983-9228		19830311		
FR 1983-9886		19830615		

GI



AB The title amorphous, single-phase solid material of high ionic cond., thermodynamical stability, cation solv., and elasticity at ambient temp. comprises an ionizable salt (LiClO₄, LiF₃CSO₃) and a **crosslinked** random polyether copolymer of ethylene oxide and a substituted ether I, where R is R₁ or -CH₂R₂R₁ and R₁ is C₁₋₁₂ alkyl, alkenyl, or alkynyl and R₂ is a polyether -(CH₂CH₂O)_p- and a cyclic ether with a C>3 ring, where p is an integer <10. The salt content is .apprx.1.5-25 wt.%. The material is used as electrolyte in a **battery**. **Crosslinked**, amorphous alkyl glycidyl ether-ethylene oxide copolymer was prep'd. and used in a secondary **battery** at a high utilization rate, which was const. over a large no. of cycles.
 ST ethylene oxide copolymer **battery** electrolyte; ether oxide copolymer **battery** electrode; glycidyl alkyl ether copolymer **battery**
 IT **Batteries**, primary
Batteries, secondary
 (electrolytes from ethylene oxide-substituted ether oxide copolymers and lithium salts)

IT Electric conductivity and conduction
 (ionic, of lithium perchlorate-contg. ethylene
 oxide-propylene oxide block copolymer, **crosslinked** amorphous,
 for **battery** electrolytes)

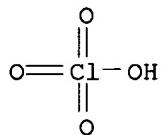
IT 75-21-8D, Ethylene oxide, alkyl glycidyl ether copolymers 556-52-5D,
 Glycidol, alkyl ethers, ethylene oxide copolymers
 RL: USES (Uses)
 (**crosslinked**, amorphous elastomeric, for **battery**
 electrodes)

IT 7791-03-9 33454-82-9
 RL: USES (Uses)
 (electrolytes from **crosslinked** poly(alkylene oxides) and, for
batteries)

IT 75-79-6D, Methyltrichlorosilane, poly(alkylene oxides) **crosslinked**
 by **triisocyanates** and trialkylaluminum and 1070-00-4D,
 Trioctylaluminum, poly(alkylene oxides) **crosslinked** by
triisocyanates and methyltrichlorosilane and 9003-11-6D,
 Ethylene oxide-propylene oxide copolymer, **polymers** with aliph.
triisocyanates **crosslinked** with methyltrichlorosilane
 and trioctylaluminum 25322-68-3D, Poly(ethylene oxide),
polymers with aliph. **triisocyanates** **crosslinked**
 with methyltrichlorosilane and trioctylaluminum 106392-12-5D, Ethylene
 oxide-propylene oxide block copolymer, **polymers** with aliph.
triisocyanates **crosslinked** with methyltrichlorosilane
 and trioctylaluminum
 RL: USES (Uses)
 (electrolytes from lithium salts and, for
batteries)

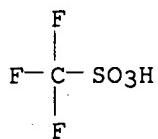
IT 7791-03-9 33454-82-9
 RL: USES (Uses)
 (electrolytes from **crosslinked** poly(alkylene oxides) and, for
batteries)

RN 7791-03-9 HCAPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



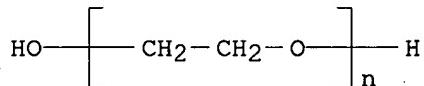
● Li

RN 33454-82-9 HCAPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

- IT 25322-68-3D, Poly(ethylene oxide), polymers with aliph. triisocyanates crosslinked with methyltrichlorosilane and trioctylaluminum
 RL: USES (Uses)
 (electrolytes from lithium salts and, for batteries)
- RN 25322-68-3 HCAPLUS
 CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX NAME)



- L21 ANSWER 42 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1988:553061 HCAPLUS
 DN 109:153061
 TI Crosslinked polyethers as media for ionic conduction
 AU Le Nest, Jean Francois; Gandini, Alessandro; Cheradame, Herve
 CS Lab. Chim. Macromol. Papetiere, Ec. Francaise Papeterie, Saint Martin d'Heres, 38402, Fr.
 SO British Polymer Journal (1988), 20(3), 253-68
 CODEN: BPOJAB; ISSN: 0007-1641
 DT Journal
 LA English
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 37, 38, 76
 AB A broad outline is given of a comprehensive investigation dealing with solid polymeric electrolytes contg. ionic species.
 These materials are based on various types of polyethers (homopolymers, block and graft copolymers) crosslinked via urethane chem. and either filled with a salt or transformed into ionomers with the anions attached to the chains. The properties studied were sp. vol., swelling, glass transition temp., viscoelasticity, ionic cond., transport nos., magnetic relaxation of nuclei from both the polymer chains and the ions, and redox stability. Mechanisms and models are proposed to explain chain partitioning by cations and the mode of ionic transport. An all-solid-state battery was prep'd. with one of these materials to prove its good performance.
 ST battery electrolyte ionic conducting polymer
 ; crosslinked polyether ionic conduction; salt polymer
 electrolyte battery; ionomer polymer
 electrolyte battery

- IT Glass temperature and transition
Transference number
(of **crosslinked** polyether electrolytes contg. lithium
salt, for **batteries**)
- IT Electric conductors
(**Polymeric, crosslinked** polyethers contg.
lithium salt, properties of, for **battery**
electrolytes)
- IT Siloxanes and Silicones, compounds
RL: USES (Uses)
(di-Me, block, graft **polymers**, with ethylene oxide-propylene
oxide - Desmodur R, metal complexes, **electrolytes**, contg.
anions, properties of, for **batteries**)
- IT Electric conductivity and conduction
(ionic, of **crosslinked** polyether electrolytes contg.
lithium salt, for **batteries**)
- IT Urethane polymers, compounds
RL: USES (Uses)
(polyether-, metal complexes, **electrolytes**, contg. anions,
properties of, for **batteries**)
- IT Siloxanes and Silicones, compounds
RL: USES (Uses)
(**Polyoxyalkylene-polyurethane-**, block, graft, metal
complexes, **electrolytes**, contg. anions, properties of, for
batteries)
- IT Urethane polymers, compounds
RL: USES (Uses)
(**Polyoxyalkylene-siloxane-**, block, graft, metal complexes,
electrolytes, contg. anions, properties of, for
batteries)
- IT Polyoxyalkylenes, compounds
RL: USES (Uses)
(**Polyurethane-siloxane-**, block, graft, metal complexes,
electrolytes, contg. anions, properties of, for **batteries**)
- IT Batteries, secondary
(solid-electrolyte, lithium, **crosslinked** polyethers
contg. lithium salt electrolytes for, properties of)
- IT 7439-93-2D, Lithium, complexes with polyether-
polyurethanes and block, graft polyether-**Polyurethane**
-siloxanes 7440-22-4D, Silver, complexes with polyether-
Polyurethanes and block, graft polyether-**Polyurethane**
-siloxanes 7440-23-5D, Sodium, complexes with polyether-
Polyurethanes and block, graft polyether-**Polyurethane**
-siloxanes
RL: USES (Uses)
(**electrolytes**, contg. anions, ion transport no. of, for
batteries)
- IT 75-21-8D, Ethylene oxide, **polymers** with propylene oxide,
Desmodur R, and di-Me siloxane, block, metal complexes 75-56-9D,
Propylene oxide, **polymers** with ethylene oxide, Desmodur R, and
di-Me siloxane, block, metal complexes 2422-91-5D, **polymers**
with ethylene oxide, propylene oxide, and di-Me siloxane, block, graft,
metal complexes 39394-47-3D, Desmodur R, **polymers** with
ethylene oxide, propylene oxide, and di-Me siloxane, block, graft, metal
complexes 116723-75-2D, metal complexes
RL: USES (Uses)
(**electrolytes**, contg. anions, properties of, salt concn. in
relation to, for **batteries**)

IT 75587-26-7D, metal complexes 75587-27-8D, Desmodur R-
polyethylene glycol copolymer, metal complexes
 RL: USES (Uses)
 (electrolytes, contg. anions, sp. vol. of, salt concn. in relation to,
 for batteries)

IT 143-66-8, Sodium tetraphenylborate 2923-17-3, **Lithium**
 trifluoroacetate 7601-89-0, Sodium perchlorate 7778-74-7, Potassium
 perchlorate 7783-93-9, Silver perchlorate 7791-03-9,
Lithium perchlorate 10034-81-8, Magnesium perchlorate
33454-82-9, **Lithium** trifluoromethane sulfonate
 RL: USES (Uses)
 (electrolytes, with polyether-**polyurethanes** and block, graft
 polyether-**polyurethane**-siloxanes, for batteries)

IT 75587-26-7 75587-27-8, Desmodur R-**polyethylene glycol**
 copolymer
 RL: PRP (Properties)
 (sp. vol. of, crosslinking molality in relation to, for
 battery electrolytes)

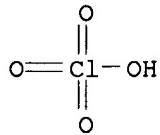
IT 7439-93-2D, **Lithium**, complexes with polyether-
polyurethanes and block, graft polyether-**polyurethane**
 -siloxanes
 RL: USES (Uses)
 (electrolytes, contg. anions, ion transport no. of, for
 batteries)

RN 7439-93-2 HCPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

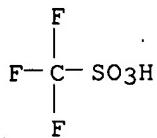
IT 7791-03-9, **Lithium** perchlorate **33454-82-9**,
Lithium trifluoromethane sulfonate
 RL: USES (Uses)
 (electrolytes, with polyether-**polyurethanes** and block, graft
 polyether-**polyurethane**-siloxanes, for batteries)

RN 7791-03-9 HCPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

RN 33454-82-9 HCPLUS
 CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



④ Li

- L21 ANSWER 43 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1987:580135 HCAPLUS
 DN 107:180135
 TI Mechanism of ionic conduction in polyether-**polyurethane** networks containing **lithium** perchlorate
 AU Le Nest, J. F.; Defendini, F.; Gandini, A.; Cheradame, H.; Cohen-Addad, J. P.
 CS Lab. Chim. Macromol. Papet., Ec. Fr. Papet., St. Martin d'Heres, 38402, Fr.
 SO Journal of Power Sources (1987), 20(3-4), 339-44
 CODEN: JPSODZ; ISSN: 0378-7753
 DT Journal
 LA English
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 36
 AB The swelling ratio of **polyethylene oxide**-**polyurethane** networks increased with the chain length in several org. liqs. without LiClO₄ and decreased when contg. the salt due to network-salt interactions involving the solvation of Li⁺ ions by O atoms of the ether. Strong interactions take place between ionic quadrupoles and 2 polyether chains, leading to reversible physicochem. (ionic) **crosslinks**. The no. of the interactions grows with salt concn. up to a limit characterized by 1 ionic **crosslink** for every 12 ethylene oxide units. An ionic transport mechanism is given on the basis of this model for solid electrolytes in **Li batteries**.
 ST **polyethylene oxide** **polyurethane**
lithium battery; ionic transport electrolyte
lithium battery; swelling **polyethylene oxide** **polyurethane** network
 IT **Batteries**, secondary
 (lithium, **polyoxyethylene**-**polyurethane**
 networks contg. lithium perchlorate electrolytes in)
 IT Swelling, physical
 (of **polyoxyethylene**-**polyurethane** networks contg.
 lithium perchlorate)
 IT Electric conductivity and conduction
 (ionic, of **polyoxyethylene**-**polyurethane**
 electrolytes contg. lithium perchlorate, for lithium
 batteries)
 IT **Urethane polymers**, compounds
 RL: USES (Uses)
 (**polyoxyethylene**-, lithium complexes, ionic
 conduction in, for lithium **battery**
 electrolytes)

IT 7439-93-2D, Lithium, polyoxyethylene-polyurethane complexes 80852-11-5D, lithium complexes
 RL: PRP (Properties)
 (ionic conduction in, for lithium battery electrolytes)

IT 7791-03-9, Lithium perchlorate (LiClO₄)
 RL: USES (Uses)
 (polymer networks contg., ionic conduction in, for lithium battery electrolytes)

IT 56-23-5, Carbon tetrachloride, properties 67-66-3, Trichloromethane, properties 71-43-2, Benzene, properties 75-09-2, Methylene dichloride, properties 7732-18-5, Water, properties
 RL: PRP (Properties)
 (swelling of polyethylene-polyurethane networks in, lithium perchlorate addn. in relation to)

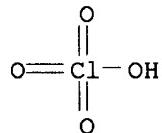
IT 7439-93-2D, Lithium, polyoxyethylene-polyurethane complexes
 RL: PRP (Properties)
 (ionic conduction in, for lithium battery electrolytes)

RN 7439-93-2 HCAPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IT 7791-03-9, Lithium perchlorate (LiClO₄)
 RL: USES (Uses)
 (polymer networks contg., ionic conduction in, for lithium battery electrolytes)

RN 7791-03-9 HCAPLUS
 CN Perchloric acid, lithium salt (8CI, 9CI) (CA INDEX NAME)



Li

L21 ANSWER 44 OF 44 HCAPLUS COPYRIGHT 2003 ACS
 AN 1985:439844 HCAPLUS
 DN 103:39844
 TI Poly(dimethylsiloxane)-poly(ethylene oxide) based polyurethane networks used as electrolytes in lithium electrochemical solid state batteries
 AU Bouridah, A.; Dalard, F.; Deroo, D.; Cheradame, H.; Le Nest, J. F.
 CS Lab. Energ. Electrochim., Domaine Univ., Saint Martin d'Heres, 38402, Fr.
 SO Solid State Ionics (1985), 15(3), 233-40
 CODEN: SSIOD3; ISSN: 0167-2738
 DT Journal

LA English
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 76
AB Ionic cond. and redox stability domain of a new type of **polymer electrolyte** were studied. The **polymer electrolytes** were prep'd. from a network of poly(dimethylsiloxane-grafted ethylene oxide) copolymer (grafted PDMS) **crosslinked** by an aliph. **isocyanate** and contg. 10 wt.% LiClO₄. Ionic conductivities >10⁻⁵/OMEGA.cm are obtained at 30.degree.. The study of the electrochem. stability of the **crosslinking** agent suggests that the unreacted **isocyanate** groups are not stable. The electroactivity domain of the grafted PDMS-10% LiClO₄ electrolyte is >3 V. The performances of a solid-state **battery** using this electrolyte were investigated. The 1st discharge and charge depths were 73%. The rechargeability was compared with that of a **Li/RuO₂ battery** with a linear high mol.-wt. [poly(ethylene oxide)]₈-LiClO₄ as electrolyte.
ST lithium **battery** electrolyte **polyurethane**; dimethylsiloxane ethylene oxide graft copolymer; **isocyanate crosslinked** copolymer electrolyte; ruthenia lithium graft copolymer **battery**
IT Batteries, secondary
(lithium-ruthenia, with lithium perchlorate-contg.
poly(dimethylsiloxane-grafted ethylene oxide) copolymer electrolyte,
performance of)
IT Electric conductivity and conduction
(of poly(dimethylsiloxane-grafted ethylene oxide) **isocyanate-crosslinked** copolymer contg. lithium perchlorate)
IT Siloxanes and Silicones, uses and miscellaneous
RL: USES (Uses)
(di-Me, copolymer of **polyethylene oxide**-, graft,
crosslinked with aliph. **isocyanate**, electrolyte from
lithium perchlorate-contg., lithium **battery**)
IT 822-06-0 26471-62-5
RL: MOA (Modifier or additive use); USES (Uses)
(**crosslinking** agents, for dimethylsiloxane-
polyethylene oxide copolymer)
IT 25322-68-3D, **polymer** with dimethylsiloxane,
crosslinked with aliph. **isocyanate**
RL: USES (Uses)
(graft, **electrolyte** from lithium
perchlorate-contg., lithium **battery**)
IT 822-06-0
RL: MOA (Modifier or additive use); USES (Uses)
(**crosslinking** agents, for dimethylsiloxane-
polyethylene oxide copolymer)
RN 822-06-0 HCAPLUS
CN Hexane, 1,6-diisocyanato- (9CI) (CA INDEX NAME)

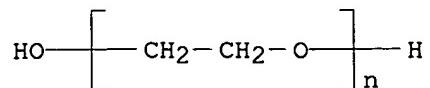
OCN-(CH₂)₆-NCO

IT 25322-68-3D, **polymer** with dimethylsiloxane,
crosslinked with aliph. **isocyanate**
RL: USES (Uses)
(graft, **electrolyte** from lithium

perchlorate-contg., lithium battery)

RN 25322-68-3 HCPLUS

CN Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy- (9CI) (CA INDEX
NAME)



Ionic Conductivity and Physical Stability Study of Gel Network Polymer Electrolytes

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Received 11 September 1999; accepted 26 October 1999

ABSTRACT: Gel polymer electrolytes (GPE) were prepared by a crosslinking reaction between poly(ethylene glycol) and a crosslinking agent with three isocyanate groups in the presence of propylene carbonate (PC) and ethylene carbonate (EC) or their mixture, and their ionic conducting behavior was carefully investigated. When the plasticizer amount was fixed, the ionic conductivity was greatly influenced by the nature of plasticizers. It was found that the conductivity data followed the Arrhenius equation in the GPE. Whatever plasticizer was used, a maximum ambient conductivity was found at a salt concentration near $[Li^+]/[EO]$ equal to 0.20. The physical stability of GPE was studied qualitatively by weight loss of GPE under pressure. It was shown that the stability was greatly affected by the network structure of the GPE and the most stable one in our research was the GPE containing the PEO₁₀₀₀ segment, which has a strong interaction between network and plasticizers. © 2000 John Wiley & Sons, Inc. *J Appl Polym Sci* 77: 2957–2962, 2000

Key words: gels; network polymer electrolytes; ionic conductivity; arrhenius equation; stability

INTRODUCTION

Solid polymer electrolytes (SPE) have been quickly developed since the pioneering investigations were carried out by Wright et al.¹ and Armand et al.² in 1970s. Due to good mechanical strength, easy packaging, and high energy densities, applications of solid polymer electrolytes as separators for lithium batteries have been given a great deal of attention in recent years. For example, electric vehicles powered by solid-state batteries are becoming “new generation” traffic tools because of their ability to meet environmental requirement, so developing an appropriate polymer electrolyte is becoming an urgent task.

The widely investigated poly(ethylene oxide) (PEO)/alkali metal salt complexes exhibit very low ambient ionic conductivity, typically 10^{-7} Scm^{-1} because of the severe crystallinity of PEO. To hinder the crystallinity of PEO, various approaches such as copolymerization,³ grafting,⁴ and crosslinking⁵ have been employed to prepare polymer hosts consisting mainly of amorphous PEO.

In our previous work,⁶ network polymer electrolytes containing PEO chains were synthesized by a crosslinking reaction. Effects of various factors, such as crosslinking density and size of network on ionic conductivity of this system, were explored in detail. Although the resultant network polymer electrolytes were completely amorphous, as indicated by X-ray diffraction measurement, their ambient ionic conductivities were still rather low—only in the range of $10^{-5} Scm^{-1}$ or lower.

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Therefore, the focus of our investigation has been turned to the gel polymer electrolytes (GPE). As is well known, gel polymer electrolytes, which are generally composed of polar polymer, alkali metal salts, and plasticizers, are a new generation of solid polymer electrolytes, and because of their high performance in the practical application to high-energy density lithium batteries, their preparation, electrical, and mechanical properties have been reported on in the last few years.⁷⁻⁹ However, so far, little has been reported about the physical stability of this kind of electrolyte. This article will present the results on the physical stability as well as ionic conductivity of these gel polymer electrolytes.

EXPERIMENTAL

Materials

Poly(ethylene oxide) (PEO) with molecular weights of 600, 800, 1000, 1500, or 2000, lithium perchlorate (LiClO_4), and plasticizers including ethylene carbonate (EC), propylene carbonate (PC), dimethyl formide (DMF), γ -butyrolactone (γ -BL), diethylene carbonate (DEC), and dimethyl ethyleneglycol (DME) were all purchased from Aldrich Chemical Company. PEO and LiClO_4 were desiccated under vacuum at 120 and 170°C, respectively for 24 h prior to use. The plasticizers were distilled under vacuum and then stored with 4 Å molecular sieves. 1,1,1-Tri(hydroxy methyl) propane (TMP) was recrystallized using methanol, and toluene 2,4-diisocyanate (TDI) was used as received.

Synthesis of the Crosslinking Agent of Gel Network Polymer Electrolytes

The detailed synthesis procedure of the crosslinking agent (TMP-TDI) was reported in our previous work.⁶ Its reaction equation is shown in Figure 1.

Preparation of Gel Network Polymer Electrolytes

PEO, TMP-TDI, and catalyst dibutyltin dilaurate (DBTDL), LiClO_4 were mixed together with a plasticizer and anhydrous tetrahydrofuran (THF) (not used sometimes). Stirring vigorously, the mixture was heated to 80°C under nitrogen atmosphere and kept at this temperature for 1 h to form a viscous liquid, which was then cast in a

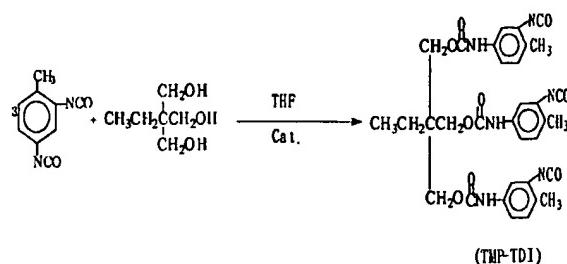


Figure 1 Synthesis of the crosslinking agent (TMP-TDI).

self-made polytetrafluoroethylene mold. After heating in the vacuum oven at 70°C for 48 h for curing, the final products were semitransparent films with good elasticity.

Measurement

The ionic conductivity was measured using an HIOKI LCR 3520 Hi TESTER at 1 kHz. The experimental procedure was the following: a disk of known area was cut from the parent electrolytes film. The disk was placed in the center of a Teflon spacer ring and compressed between two stainless rods inserted into opposite ends of the Teflon spacer ring. The thickness of the samples was taken to be the Teflon spacer thickness for relatively thin and compressible samples, while the electrolyte thickness was measured with calipers for thicker and more rigid samples.

To estimate the gel fraction of the synthesized network polymers, weighed amounts of network polymers were extracted using tetrahydrofuran (THF) as the extracting solvent for 24 h on Soxhlet's extractors. After extraction, the gelled polymer was placed in a vacuum oven at 100°C for 24 h to get rid of the solvent, and the weight of the polymer was measured again. The gel fraction was calculated according to the following equation:

$$\text{Gel\%} = \frac{100B}{A}$$

where A and B are weights of the network polymers before and after the extraction, respectively.

To study the physical stability of gel polymer electrolytes, a simple experiment was carried out on various systems. The samples were subjected to a fixed downward pressure (the weight of the downward object was fixed at 10 kg, and the areas of various samples were fixed at 4 cm²). For var-

Table I Gel Fraction of the Network Polymers Containing Various PEO Segments

Samples	PEO Molecular Weight (M_w)	Gel Fraction ^a (%)
NT-PEO ₆₀₀	600	98.3
NT-PEO ₁₀₀₀	1000	97.5
NT-PEO ₁₅₀₀	1500	95.6
NT-PEO ₂₀₀₀	2000	94.0

^a Tetrahydrofuran (THF) as the extracting solvent for 24 h on Soxhlet's extractor.

ious time intervals, the weight of each GPE sample were measured. The percent of weight loss is calculated according to the following equation:

$$\text{Weight loss \%} = 100B/A$$

where A is the sample weight before exerted pressure, B is the sample weight after exerted pressure for different time intervals.

RESULTS AND DISCUSSION

Table I lists the gel fraction of the network polymers containing various PEO segments. It can be seen from Table I that, with increasing of molecular weight of the PEO segment, the gel fraction is decreased proportionally from 98.3 to 94.0%. The results are relevant to the reactivity of poly(ethylene glycol) in the crosslinking reaction. The terminal hydroxy (μOH) on the longer PEO₂₀₀₀ segment is less active in the crosslinking reaction compared to that on the shorter PEO₆₀₀ segment. The 97.5% gel fraction of the network polymer containing the PEO₁₀₀₀ segment is high enough to prepare gel network polymer electrolytes.

All gel polymer electrolytes showed a great enhancement of ambient conductivity compared to the electrolytes without plasticizers. Figure 2 offers a clear example of the above-mentioned difference. The ionic conductivity of GPE is nearly 2–3 orders of magnitude higher than that of the conventional electrolytes, as indicated in Figure 2, and the maximum conductivity of GPE appeared at $[\text{Li}^+]/[\text{EO}]$ equal to 20%, which is much higher compared to the 10% of the conventional electrolytes. This phenomena is ascribed to the permittivity increasing of the whole GPE system, because the introduced PC plasticizer has a high

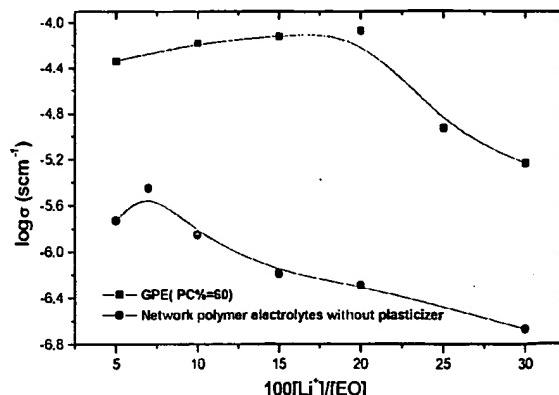


Figure 2 Ambient ionic conductivity of GPE and the unplasticized network polymer electrolytes containing the PEO₁₀₀₀ segment.

relative permittivity ($\epsilon = 64.4$ at 25°C), which will contribute to the enhancement of the dissociation of ion pairs or ion clusters. At the same time, the apparent softer GPE films, relating to the plasticizing effect of PC, exhibit a much lower glass transition temperature ($T_g = -60.2^\circ\text{C}$) than that of the unplasticized one ($T_g = 23.7^\circ\text{C}$).

The effect of plasticizers on the polymer mobility and conductivity depends on the specific nature of the plasticizers, including viscosity, dielectric constants, polymer–plasticizer interaction, and ion–plasticizer coordination. Table II lists the ambient conductivity data of the GPE with various plasticizers.

Ionic conductivity of GPE films containing PC, EC, and EC/PC mixed plasticizers, as a function

Table II Effect of Plasticizer on Ionic Conductivity of Gel Polymer Electrolytes^a

Plasticizer ^b	$[\text{Li}^+]/[\text{EO}]$ (%)	Ambient Conductivity (σ, Scm^{-1})
no	10	6.38×10^{-7}
DME	10	9.70×10^{-7}
DEC	10	1.14×10^{-6}
EC	10	3.75×10^{-5}
EC/PC (1 : 3 v/v)	10	5.48×10^{-5}
PC	10	6.68×10^{-5}
EC/PC (3 : 1 v/v)	10	4.25×10^{-4}
DMF	10	3.71×10^{-6}
γ -BL	10	1.06×10^{-4}

^a GPE containing the PEO₁₀₀₀ segment;

^b Weight of all kinds of plasticizers was fixed at 60%.

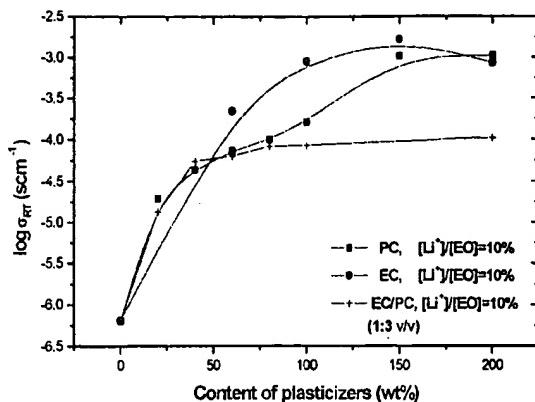


Figure 3 Effect of the content of the plasticizers on room temperature conductivity for the GPE containing the PEO₁₀₀₀ segment.

of the amount, is shown in Figure 3 for the series of the GPE system in which the PEO molecular weight is 1000. A maximum conductivity equal to 1.1×10^{-3} Scm⁻¹ at room temperature is observed in the GPE containing 200% (weight) PC plasticizer. No significant increase in the conductivity values are found when the amount of PC or EC/PC (1 : 3 v/v) plasticizer is increased from 20 to 100%; however, the conductivity for EC plasticized GPE showed substantial variation. For EC plasticized GPE, ionic conductivity was increased when EC increased from 50 to 150%. Above 150%, the conductivity dropped slightly, probably due to the tendency of EC to crystallize at room temperature. Although the dissolved EC was combined with the network skeleton intimately, and acted as an ionic conducting channel, at high enough levels, EC will crystallize, reducing ion migration.

The conductivity results for GPE with mixed plasticizers are also shown in Figure 3. The mixture of plasticizers was chosen with the ratio EC/PC = 1 : 3, where the EC/PC ratio refers to the volume ratio of the plasticizers EC and PC. With a 1 : 3 mixture of plasticizers EC and PC, the GPE shows conductivity values lower than those for samples with pure PC or pure EC at all temperatures studied.⁷

Arrhenius plots for GPE and unplasticized network polymer electrolytes are depicted in Figure 4 for different plasticizer levels, and in Figure 5 for different salt levels. As shown in Figure 4, the Arrhenius plots of all the plasticized electrolytes are almost linear, which is different from the curved line of the unplasticized network polymer

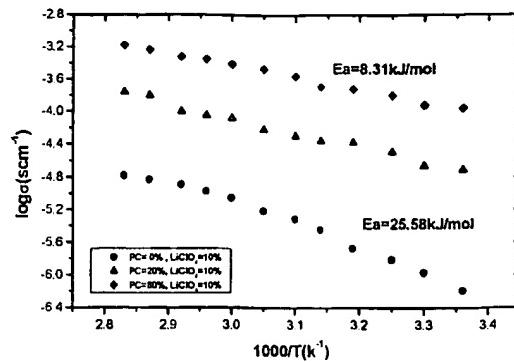


Figure 4 Arrhenius plots for the GPEs with the PC plasticizer.

electrolytes. The calculated activation energy for the investigated PC plasticized GPE is 8.31 kJ/mol, which is much lower than that of the unplasticized network polymer electrolytes (25.58 kJ/mol, calculated from the VTF equation). Ion migration in the network polymer electrolytes follows the VTF equation, and is probably due to the segmental movement of the polymer. In the GPEs, the network polymer matrix offers little contribution to ion conduction, and the plasticizers act as the main channel for ion migration.

A different effect of temperature on ionic conductivity is shown in Figure 5. In the low temperature range, the ionic conductivities of the three GPEs with different LiClO₄ concentrations exhibit no significant difference, but at higher temperatures, the difference is extremely large. One interpretation is that the dissociation of LiClO₄ becomes easier with increasing temperature.

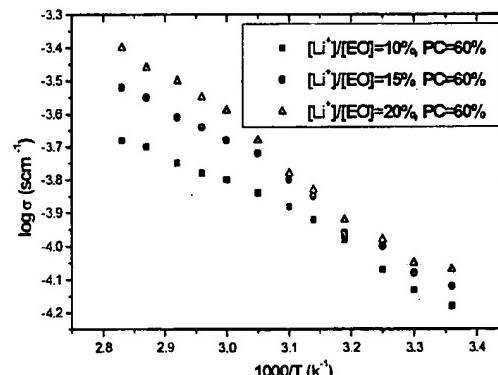


Figure 5 Effect of temperature on the GPE containing the PEO₁₀₀₀ segment.

Successful gel polymer electrolytes call for both dimensional stability and ambient high ionic conductivity. The leakage of plasticizers from the polymer matrix will result in an unstable electrolytes/electrode interface caused by the reaction with the active electrode. A simple experiment was carried out to investigate this aspect on our synthesized GPEs. The subject GPE had the same plasticizer PC, where the amount was fixed at 200% of the network polymer host. The results are depicted in Figure 6.

The weight loss directly relates to the interaction between the network polymer and the plasticizers. This interaction alters with the plasticizer nature and the network structure. When the plasticizer and its amount are fixed, the interaction will be influenced only by the network structure. After a fixed pressure for 1 day, the weight loss percent of GPEs with different structures was identical, about 2% (weight). Five days later, the GPE containing the PEO₁₅₀₀ segments had a relatively higher weight loss compared to that of the GPEs containing the PEO₁₀₀₀ and PEO₆₀₀ segments. After 12 days or longer, the weight loss of any GPEs was not altered, and kept the same order: GPE(PEO₁₅₀₀) > GPE (PEO₆₀₀) > GPE(PEO₁₀₀₀).

It is clear that the GPE containing PEO₁₀₀₀ is the best candidate electrolyte due to its good dimensional stability. Too large or too small a network size is detrimental to the dimensional stability of GPE. So we made a further investigation on the ambient conductivity of GPE containing the PEO₁₀₀₀ segment. Figure 6 is the relationship between the plasticizer weight loss and the ambient ionic conductivity. It can be observed from

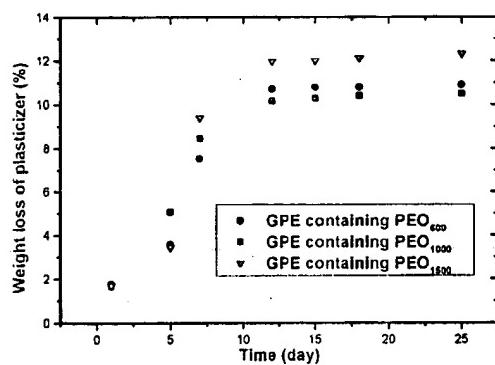


Figure 6 Weight loss of different GPEs with the same plasticizer content (200%) as a function of time.

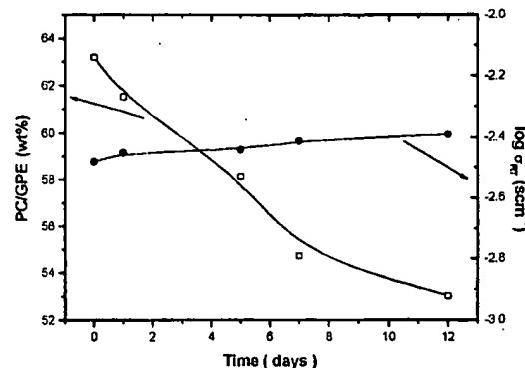


Figure 7 Relationship between weight loss and ambient conductivity for GPEs containing the PEO₁₀₀₀ segment.

Figure 7 that although the PC content is decreased from 63.7 to 53.7% after 12 days, the GPE has no significant deterioration in ambient ionic conductivity, which is consistent with the results obtained from Figure 3.

CONCLUSIONS

The gel network polymer electrolytes exhibit ambient conductivities of nearly three orders of magnitude higher than those of unplasticized electrolytes. The effect of LiClO₄ concentration on ionic conductivity is slightly different from the conventional one, except for the appearance of a maximum ionic conductivity. Different plasticizers will affect ionic conductivity due to different variability in characteristics such as permittivity and viscosity. The GPEs investigated in our study followed the Arrhenius plots, not the VTF type, which indicated that ionic migration in the GPE mainly takes place in channels existing in the plasticizers. GPEs with different network structure have different physical stability, among which the GPE containing the PEO₁₀₀₀ segment gave the best stability after a long time pressure, mainly due to the stronger interaction between the plasticizer and the networks. In the GPE containing the PEO₁₀₀₀ segment, the ambient conductivity showed no significant alteration when the plasticizers escaped from the networks under pressure.

We are indebted to Professor Youhuai Wang and Yongjun Li for their valuable suggestions. This re-

search is financed by the "863" Research Project of People's Republic of China.

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Crosslink d Polyethers as Media for Ionic Conduction

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(Received 2 July 1987; accepted 13 October 1987)

Abstract: A broad outline is given of a comprehensive investigation dealing with solid polymeric electrolytes containing ionic species. These materials are based on various types of polyethers (homopolymers, block and graft copolymers) crosslinked via urethane chemistry and either filled with a salt or transformed into ionomers with the anions attached to the chains. The properties studied were specific volume, swelling, glass transition temperature, viscoelasticity, ionic conductivity, transport numbers, magnetic relaxation of nuclei from both the polymer chains and the ions, and redox stability. Mechanisms and models are proposed to explain chain partitioning by cations and the mode of ionic transport. An all-solid-state battery was prepared with one of these materials to prove its good performance.

Key words: Polyether networks, ionomeric networks, ionic conductivity, glass transition temperature, swelling, nuclear magnetic relaxation, viscoelasticity, transport number, solid polymer electrolyte, redox stability, batteries.

1 INTRODUCTION

The use of macromolecular materials as electrolytes for solid-state batteries was first envisaged over a decade ago.^{1,2} The underlying features sought for these polymers were good solvating power *vis-à-vis* the cations (which of course implies a reasonable solubility of the salt in the macromolecular matrix), an essentially cationic charge transport leading to conductivities as high as possible, and an adequate electrochemical stability. Linear polyethers were initially studied and conductivities of about $10^{-5} \text{ S cm}^{-1}$ obtained at room temperature with various salts.²

Since then, many laboratories have been tackling these problems with different materials and working hypotheses.³ Three major drawbacks were soon encountered: (i) crystallization of part of the polymer (high DP) which relegates ionic mobility to the amorphous regions;⁴ (ii) lack of dimensional stability due to creep, particularly at higher temperatures; (iii) cationic transport numbers much lower than unity.⁵

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The approach chosen in our laboratory⁶⁻²¹ called upon the basic premise that crosslinking the polyether chains would minimize crystallization and eliminate creep. As for a solution to the third problem, ionomeric networks with anions fixed on the chains were envisaged. This paper presents a panoramic view of the different sets of results obtained with networks containing either a dissolved salt or an attached ionizable moiety. From this wide investigation which began at the end of the last decade, conclusions will be proposed concerning molecular-scale models of ion-chain interactions, the origin and mode of ionic transport and the electrochemical performance of some of these systems.

2 EXPERIMENTAL

2.1 Network preparation

Most of the networks were based on the use of multifunctional isocyanates as crosslink agents reacting with polyether chains through their terminal or pendant hydroxyl groups. However, other

(a) Polyether-ols

TABLE 1. Network precursors

Polyol, formula (abbreviation)	Source	M_n	F_n^*	M_w/M_n
Poly(ethylene oxide) α,ω -diol (PEO) $\text{HO} \leftarrow \text{CH}_2\text{CH}_2\text{O} \rightarrow_n \text{H}$	Merck	220 420 620 1 050 1 550 2 100 3 200 3 800 6 000 10 000	2.07 2.04 2.03 2.03--"2.04" 2.02 2.05--"2.05" 2.05 2.07 2.08 2.06	1.03 1.03 1.03 1.05 1.05 1.06 1.04
Poly(propylene oxide) α,ω -diol (PPO) $\text{HO} \leftarrow \underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{O} \rightarrow_n \text{H}$	Aldrich	1 030 2 020	2.01 2.01	1.03
Tris(poly(propylene oxide) ω -ol) glycidyl ether $\text{CH}_2-\text{O} \leftarrow \text{CH}_2\text{CHO} \rightarrow_3 \text{H}$ $\text{CH}-\text{O} \leftarrow \text{CH}_2\text{CHO} \rightarrow_3 \text{H}$ $\text{CH}_2-\text{O} \leftarrow \text{CH}_2\text{CHO} \rightarrow_3 \text{H}$	Lankro	1 490	3.00	
Triblock copolymers α,ω -diol (PEO-b-PPO-b-PEO) (a) $\text{HO}(\text{C}_2\text{H}_4\text{O})_{12}(\text{C}_3\text{H}_6\text{O})_{17}(\text{C}_2\text{H}_4\text{O})_{46}\text{H}$ (Pluronic F 38) (b) $\text{HO}(\text{C}_2\text{H}_4\text{O})_{18}(\text{C}_3\text{H}_6\text{O})_{26}(\text{C}_2\text{H}_4\text{O})_{76}\text{H}$ (Pluronic F 68)	BASF Wyandotte and Ugine Kuhlmann	4 980 8 390	2.03 2.04	
Graft-block copolymers polydimethylsiloxane-g-polyether-(b) PDMS-g- \leftarrow PPO-b-PEO OH $(\text{CH}_3)_3\text{Si} \leftarrow \text{OSi} \rightarrow_{28} \text{OSi} \rightarrow_{14} \text{OSi}(\text{CH}_3)_3$ (R = $-\text{CH}_2\text{CH}_2\text{CH}_2(\text{OC}_2\text{H}_5)_{10}-(\text{OC}_2\text{H}_5)_{12}\text{OH}$)	Rhône-Poulenc	19 400	14	

^{*} Average functionality (OH) as determined by acetylation or ¹H n.m.r. ("")

(b) Multifunctional isocyanates

Compound, formula (abbreviation)	Source	Molar mass
Hexamethylene diisocyanate $\text{OCN}(\text{CH}_2)_6\text{NCO}$ (HMDI)	Merck	168
Toluene 2,4-diisocyanate $\text{CH}_3\text{C}_6\text{H}_3(\text{NCO})_2$ (TDI)	Fluka	174
4,4',4"-Methyldiene tris(phenylisocyanate) $\text{HC}(\text{C}_6\text{H}_4\text{NCO})_3$ (Desmodur R) $\text{OCN}(\text{CH}_2)_6\text{N}(\text{CONH}(\text{CH}_2)_6\text{NCO})_2$ (Desmodur N)	Bayer	367 478

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methods of reticulation were also tested, namely the reaction of polyether OH end-groups with POCl_3 and PSCl_3 , with $\text{Ti}(\text{OR})_4$ or AlEt_3 ; the preparation and polymerization of difunctional acrylic and vinylic polyether macromers;²² the γ -ray irradiation of linear high-DP polyethers; and the interaction between tetramethyltetrahydrosiloxane (D4H) and diallyl polyethers.²³ The urethane technique of crosslinking gave the most reliable materials and was therefore given preference. Thus, the largest part of the work described here relates to these networks which were structurally more uniform and well-defined than most others. An indication of their quality is illustrated by the fact that extractions with different solvents gave soluble material amounting to less than 0.5%. Investigation of the properties of the other networks was limited to a set of comparative tests and only in the specific instance of siloxane-based polyether networks does it seem likely that one could get good control over the crosslinking process, and a behaviour and performances as interesting as with the urethane-based counterparts.

2.1.1 Networks with added salts. Neutral networks possessing a wide variety of structures were synthesized from carefully dried nearly monodisperse polyether glycols, triols or polyols and di- or triisocyanates.²⁴ Table 1 lists these starting materials and their properties, and shows the scope of this work in terms of variety of structures and chain lengths explored. This includes classical variables such as the DP of the polyether precursor, the type of unit in these oligomers and the structure of the isocyanates, and also more elaborate situations like the use of block and graft copolymers as the polyether precursor. In some specific instances, another variable was carefully controlled, namely the concentrations during synthesis, to allow a study of the swelling behaviour of the networks as discussed below. To all these networks different anhydrous salts were added, either directly before the crosslinking operation or into the final reticulate by

TABLE 2. Metal salts tested

Formula	Source	Molar mass
LiClO_4	G. Frederick Smith	106.4
LiCF_3SO_3		156.0
LiBF_4	Ventron	93.8
LiCF_3CO_2	Ventron	120.0
LiSCN	Fluka	65.0
NaClO_4	Riedel-de-Haen	122.4
KClO_4	Merck	138.6
$\text{Mg}(\text{ClO}_4)_2$	Merck	223.2
$\text{NaB}(\text{C}_6\text{H}_5)_4$	Merck	342.2

diffusion. The range of salts investigated is shown in Table 2.

The actual crosslinking procedure consisted of carrying out the (catalysed) reaction between the components added in stoichiometric amounts ($\text{OH}/\text{NCO} = 1$) inside a flat mould made of silylated glass. This afforded a regular sheet of material without bubbles and with constant thickness. Details of these syntheses have been reported elsewhere.⁸ These membranes were stored in an inert atmosphere and cut and transferred to the specific measuring device without exposure to moisture.

2.1.2 Ionomeric networks. Different techniques were used to attach anionic moieties covalently to the network chains. The first involved preparing polyether-urethane networks bearing phosphate or thiophosphate anions. It implied an initial reaction between POCl_3 or PSCl_3 and excess polyether glycol (typically two glycol molecules per phosphorus reagent) so as to obtain short chains with OH end-groups and $\text{OP}-\text{Cl}$ groups which were then transformed into $\text{OP}-\text{O}^-\text{Mt}^+$. Crosslinking took place with triisocyanates according to the procedure described above for neutral networks. Details of the preparations of a variety of such ionomeric materials have been given elsewhere.²⁵

The second approach called upon the use of a polyether polyol on which a fraction of the OH groups were transformed into alkali metal alcohohlates. Then a Lewis acid was added to this polymer in order to enhance the dissociation of the ionizable group, e.g. $-\text{OLi} + \text{SbCl}_5 \rightarrow -\text{O}(\text{SbCl}_5)^- + \text{Li}^+$. These ionomers were finally crosslinked by the reaction of specific multifunctional isocyanates with the remaining OH groups left on the polyether chains. The specific features of these operations have been described.²⁶

Finally, a third technique was adopted. It consisted of treating a polyether polyol with a reagent containing an ionized group and an acid chloride moiety, e.g. $\text{ClOC}(\text{CF}_2)_3\text{COO}^-\text{Li}^+$, to obtain the corresponding ester-type ionomer. Crosslinking with isocyanates concluded the operation.²⁶

2.2 Network properties

2.2.1 Specific volume. The specific volumes of the various materials were determined by pycnometry with mercury.

2.2.2 Glass transition temperature. T_g values of these materials were obtained by differential scanning calorimetry (d.s.c.) with a Dupont 990 instrument. Given the propensity of some networks to display local crystallization phenomena, all samples were heated at 100°C and quenched in liquid nitrogen before analysis.

2.2.3 Swelling. The amount of liquid intake by a given system was determined gravimetrically after equilibrium had been reached.

2.2.4 Dynamic mechanical properties. The viscoelastic behaviour of the materials was studied at different frequencies and temperatures on a Rheovibron DDV-II analyser.

2.2.5 Ionic conductivity. The complex-impedance method was applied¹⁰ using a Solartron 1174 instrument.

2.2.6 Transport numbers. As already published,¹³ the choice of technique for the determination of this parameter rested on Tubandt's method.

2.2.7 Nuclear magnetic relaxation. The behaviour of ¹H, ⁷Li, ¹¹B, ¹⁹F and ³¹P nuclei was analysed with a Bruker WP100 FT spectrometer.

3 RESULTS AND DISCUSSION

3.1 Specific volume

The variation of the specific volume of polyether networks was studied in two well-defined contexts.

3.1.1 Saltless networks. The relevant variable in saltless networks is the crosslink density for a given type of polyether, the influence of the nature of the isocyanate used to prepare the network being negligible. Figure 1 shows the linear dependence of \bar{V} for poly(ethylene oxide), PEO, at 22°C, on the crosslink molality m (which was varied by using PEO glycols of different DP). From these results, the simple relationship (1) is obtained:

$$\bar{V} = \bar{V}_0 - 0.11m \quad (1)$$

where \bar{V}_0 is the specific volume extrapolated linearly to $m=0$ (Fig. 1). This parameter represents the specific volume of a linear amorphous PEO of very high DP. The fact that the experimental points at very low m deviate from the extrapolated linear plot is due to the important contribution of crystalline regions arising from the ease with which long PEO chains can form organized domains. Equation (1) can be further developed taking into account the contribution of the urethane links to the changes in specific volume. This more precise approach has been given elsewhere.^{18,24}

3.1.2 Salt-containing networks. Two sets of measurements were carried out, using in each case fixed network structures and segmental sizes and varying the molality m' of the added salt, LiClO₄. The first

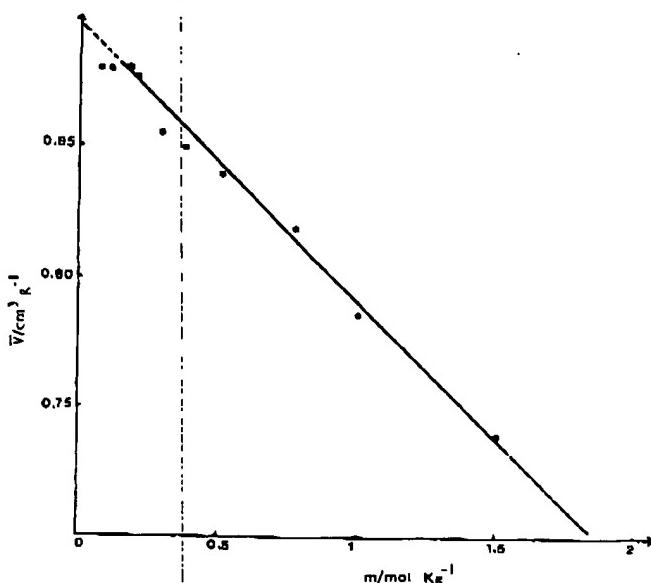


Fig. 1. Dependence of the specific volume on crosslinking molality, for a series of networks prepared with PEO glycols of different DP and Desmodur R triisocyanate (see Table 1).

involved a PEO glycol of $M_n = 1050$, the second a PEO glycol of $M_n = 2100$. Figure 2 shows the results obtained with both systems. The two straight lines are parallel and the equation describing them is

$$\bar{V} = \bar{V}'_0 - 0.051m' \quad (2)$$

where \bar{V}'_0 is the specific volume of the corresponding saltless network. If one were to assume that volume additivity could be applied to these situations, it would follow that

$$\bar{V} = \bar{V}'_0 - 0.046m' \quad (3)$$

as shown by the dotted line in Fig. 2. The coefficient 0.046 was calculated from the specific values of PEO 1050-based network and of LiClO₄. For systems involving PEO 2100 its value was 0.047. The experimental results indicate, however, that when the salt is dissolved in these networks a relative contraction $-\Delta\bar{V}$ takes place with respect to linear volume additivity, such that

$$-\Delta\bar{V} = 0.005m' \quad (4)$$

This phenomenon is probably due to complexation between the lithium cation and the electron doublet on the ether oxygen atoms of the PEO chains. In other words, Li⁺ ions introduce ion-dipole cross-links by interacting with the network chains. A comparison of this effect (Fig. 2) with the extent of contraction produced by an increase in crosslink density (Fig. 1) shows that the latter phenomenon produces a much more drastic reduction of the free volume of the network than does the former.^{18,24} The reason for the departure of the upper curve of Fig. 2 from linearity is not clear at present.

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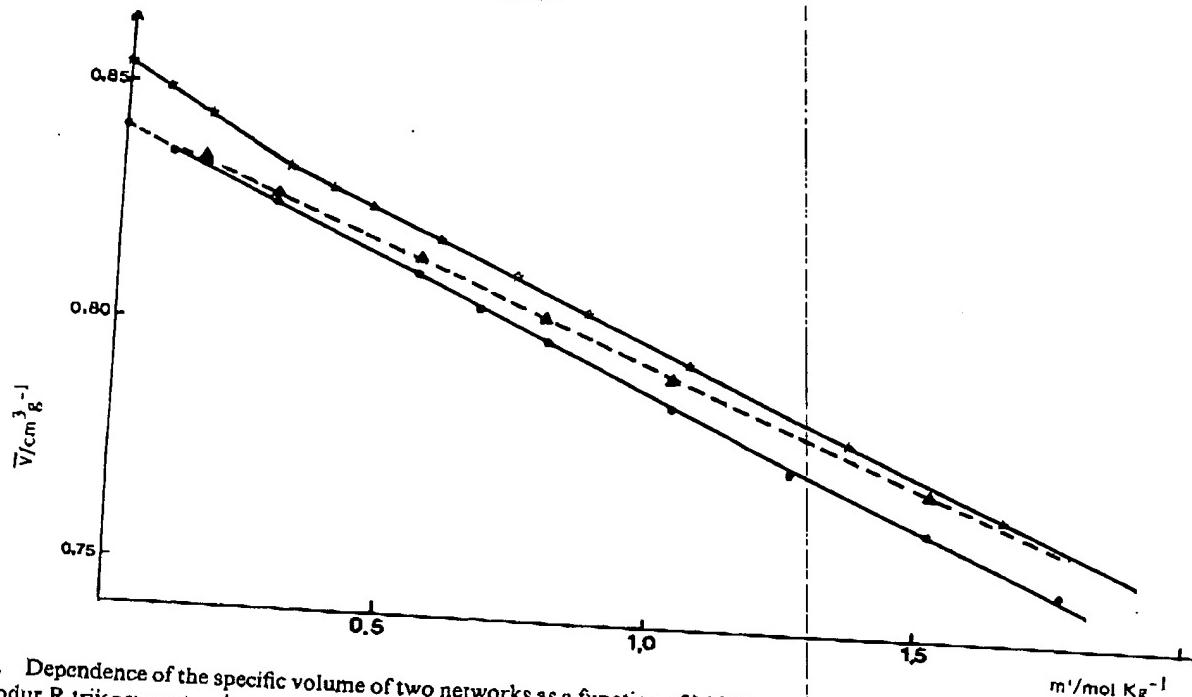


Fig. 2. Dependence of the specific volume of two networks as a function of LiClO_4 molarity m' . ●, networks based on PEO 1050 and Desmodur R triisocyanate; ★, networks based on PEO 2100 and Desmodur R triisocyanate; ▲, calculated behaviour in the case of specific volume additivity between salt and network.

3.2 Glass transition temperature

The networks investigated were the same as in the preceding section.

3.2.1 Saltless networks. Figure 3 shows that a linear relationship holds between T_g^{-1} and the crosslink molarity c :

$$T_g^{-1} = T_{g0}^{-1} - 7.6 \times 10^{-4} c \quad (5)$$

where T_{g0} is the glass transition temperature obtained by extrapolating the straight line in Fig. 3 to $c = 0$. If one rewrites eqn (5) introducing the relative variation of T_g , and inserting the value $T_{g0} = 209 \text{ K}$ one obtains:

$$\frac{T_g - T_{g0}}{T_{g0}} = \frac{0.16c}{1 - 0.16c} \quad (6)$$

which has the same form as a Di Marzio's classical relationship:²⁷

$$\frac{T_g - T_{g0}}{T_{g0}} = \frac{ac}{1 - ac} \quad (7)$$

3.2.2 Salt-containing networks. Three distinct networks were used to study the effect of LiClO_4 concentration on the glass transition temperature. Figure 4 illustrates again the linear dependency of T_g^{-1} on the molar concentration c' of the salt. Interestingly the slope of these lines is independent

of the length of the PEO segments between urethane crosslinks:

$$T_g^{-1} = T_{g0}^{-1} - 2.7 \times 10^{-4} c' \quad (8)$$

where T_{g0} is the glass transition temperature of each corresponding saltless network. It is worth mentioning that the same slope was found when using different triisocyanates^{18,24} and D4H²³ as crosslink agents. On the other hand, replacing the PEO chains with PEO-PPO blocks (Table 1) induces an apparent increase in the slope, the linearity being, however, respected. It can be shown²⁴ that the complexation of Li^+ is much more favoured for the PEO segments and that by using a recalculated concentration based on this fact, a slope close to $2.7 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ K}^{-1}$ is again obtained.²⁴

Finally, if a PDMS-g(PEO-b-PPO) polyol (Table 1) is used to construct the networks, the partition of lithium cations is even more selective in that the silicone trunk chains do not solvate these cations at all, which therefore complex again, mostly with the PEO segments. The silicone chains however, play an important role in substantially lowering the glass transition temperature.^{14,24} The concept of ion-dipole crosslinking arising from the complexation of a lithium cation with two PEO chains applies here in a more explicit fashion than with the results concerning specific volume. Comparison of Figs. 3 and 4 indicates that (i) increasing either the crosslink density or the salt concentration induces an increase in T_g and (ii) the effect of the former is more

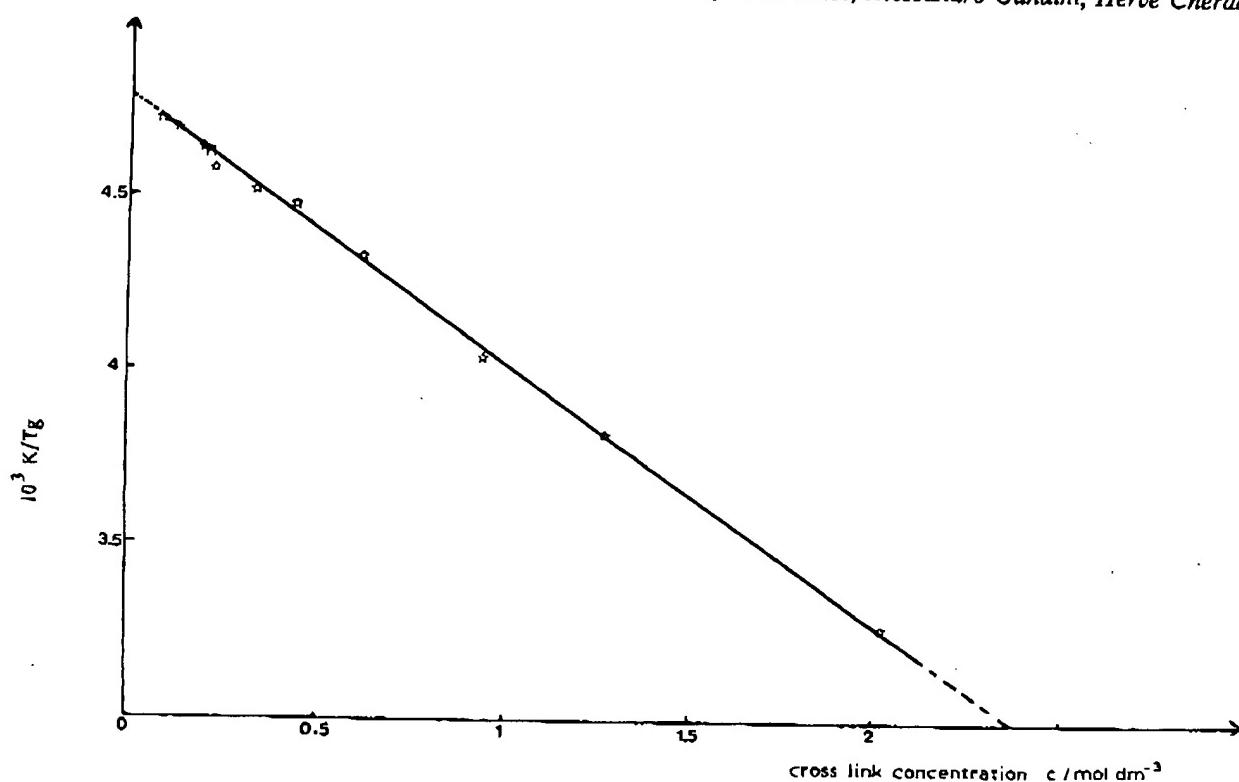


Fig. 3. Dependence of the inverse of T_g on crosslinking molarity c , for a series of networks based on PEO glycols of different DP and Desmodur R triisocyanate.

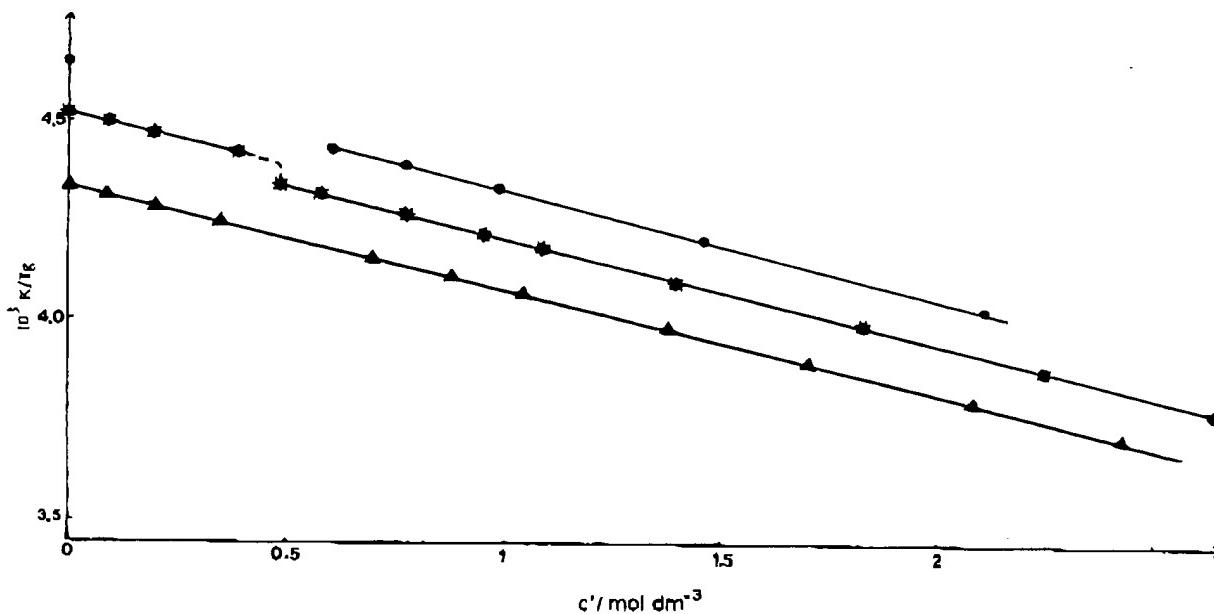


Fig. 4. Dependence of the inverse of T_g as a function of LiClO_4 molarity c' . ▲, Networks based on PEO 1050 and Desmodur R triisocyanate; ★, networks based on PEO 2100 and Desmodur R triisocyanate; ○, networks based on PEO 3800 and Desmodur R triisocyanate.

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important than that of the latter by a factor of about 3 (ratio of the slopes). As a consequence, these systems can be described within a single general framework which allows the prediction of the glass transition temperature for any network involving PEO and LiClO₄ through an appropriate abacus.²⁴

3.3 Swelling properties

The behaviour of the networks discussed in the previous sections (with and without added salts) towards swelling in various types of liquids has already been partly reported.^{19,21} Whereas with relatively polar liquids the decrease of the swelling ratio q (v/v) with increasing salt concentration followed a linear trend, the same plots with non-polar liquids gave a marked non-linear decrease followed by a tailing off at high LiClO₄ concentrations. The trend observed with saltless

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networks as a function of the crosslink concentration was the same as that described above with non-polar liquids.^{19,21} Assuming again that the lithium cations play the role of crosslink agents, it was possible to show that the behaviour of these systems in non-polar solvents could be rationalized quantitatively with and without added salt; it was found that one ionic (complexation) crosslink afforded the same effect as one urethane crosslink.^{19,21} On the contrary, with polar solvents, the ionic interactions with the PEO chains are loosened and as a consequence, the effect of salt concentration on q considerably reduced.

The three types of measurements described thus far in this overall investigation have provided complementary evidence to show that the introduction of a metal salt into a polyether-type matrix brings about reversible dynamic crosslinking due to ion-dipole binding of chain segments induced by the ionic species.

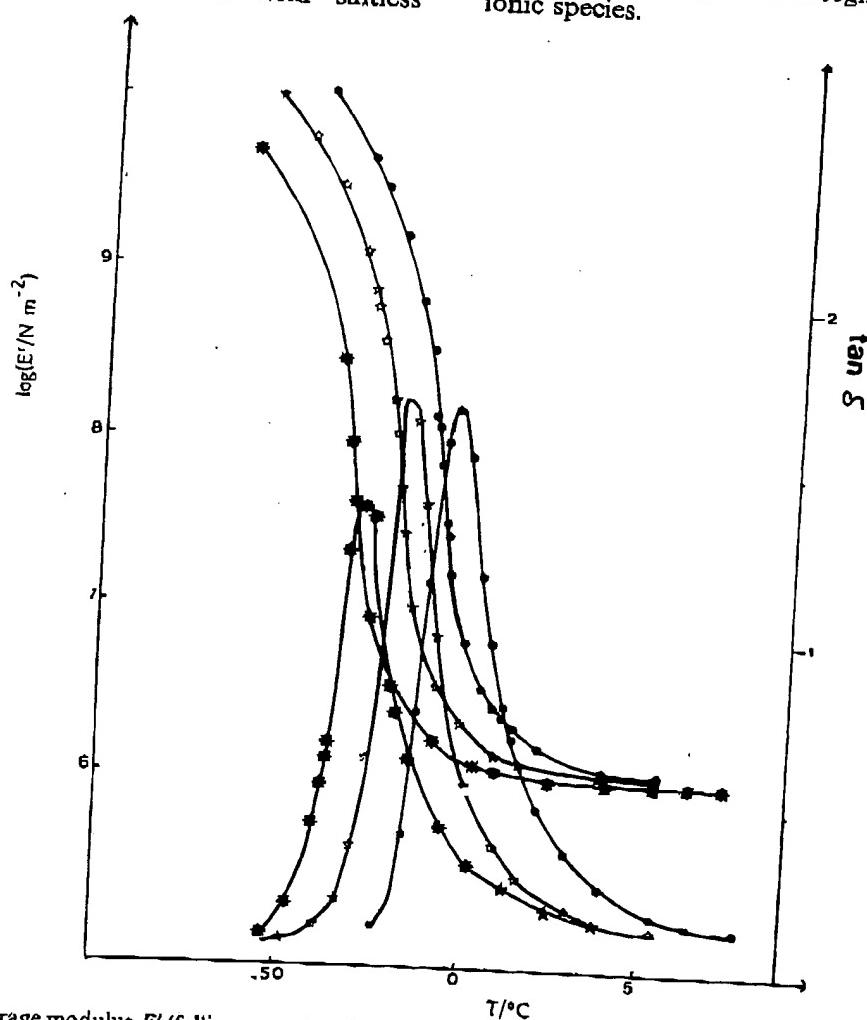


Fig. 5. Variations of storage modulus E' (falling curves) and loss tangent $\tan \delta$ (curves with maxima) as a function of temperature at 11 Hz for a network prepared from PEO-b-PPO-b-PEO ($M_n = 4980$, see Table 1) and Desmodur R triisocyanate, and containing LiClO₄: ★, 12% w/w; □, 16% w/w; ▲, 23% w/w.

3.4 Dynamic mechanical properties

Previous studies in this laboratory on the viscoelastic behaviour of networks based on PEO or PPO and containing various salts^{8,9,18} led to the establishment of master curves (WLF) correlating as usual the storage modulus with frequency and temperature but also with a novel parameter, i.e. the salt concentration. This investigation has now been extended to new networks based on PEO-b-PPO-b-PEO glycols and PDMS-g(PPO-b-PEO) polyols (Table 1) crosslinked with various di- and triisocyanates and filled with different concentrations of lithium perchlorate. Figures 5, 6 and 7 provide an example of the dynamic chemical properties on one such type of network based on polyether block copolymers. As in previous studies, the classical WLF features were clearly observed (Fig. 6), including the superposition with respect to salt concentration (Fig. 7). Table 3 gives the C_1 and C_2 values at T_g for these networks. With PDMS-based systems the results were entirely similar.

3.5 Ionic conductivity

It has already been shown^{6,10,14,15,18} that the transport of ions across polyether-based networks

TABLE 3. WLF constants^a for the networks characterized in Figs 5-7, with T_g as reference temperature

Salt conc. (% w/w)	C_1	C_2 (K)	T_g (K)
12	10.5	48	240
16	10.4	51	248
23	10.1	50	265

$$^a \log_{10} \alpha_T = -\frac{C_1(T - T_g)}{C_2 + T - T_g}$$

follows a free-volume law, i.e. WLF behaviour. However, this was carried out with a limited number of systems and only recently further studies have considerably expanded the scope of this investigation. In particular, it was shown that the C_1 and C_2 values obtained from a WLF treatment of the conductivity-vs-temperature data^{18,28} were all very similar ($C_1 = 10 \pm 2$ and $C_2 = 50 \pm 5$ K) for a large number of materials. More specifically the two constants were found to be independent of (i) the nature of the crosslinking agent, viz. the structure of the triisocyanate used^{18,28} and D4H;²³ (ii) the length of the polyether glycol precursor; (iii) the nature of the polyether (structure, homopolymer, block or graft copolymer, cf. Table 1); (iv) the alkali metal ion

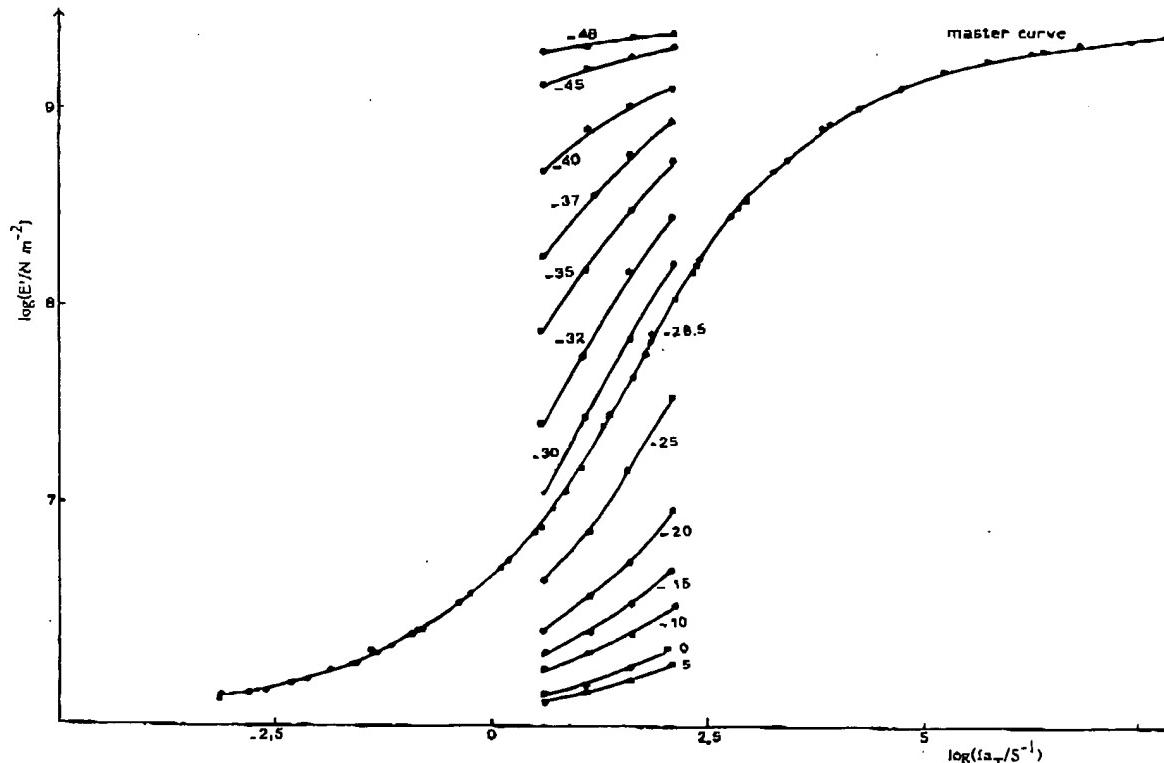


Fig. 6. A typical master curve constructed from data referring to the network containing 12% LiClO₄ [(w/w), cf. Fig. 5] using a reference temperature of -28.5°C. The central parts of the curves, with appropriate temperatures in °C from which the master curve is constructed, are also shown. α_T is the product of the excitation frequency (s⁻¹) and the shift factor defined as the ratio of the relaxation times at T and T_g respectively, viz. $\alpha_T = \tau(T)/\tau(T_g)$.

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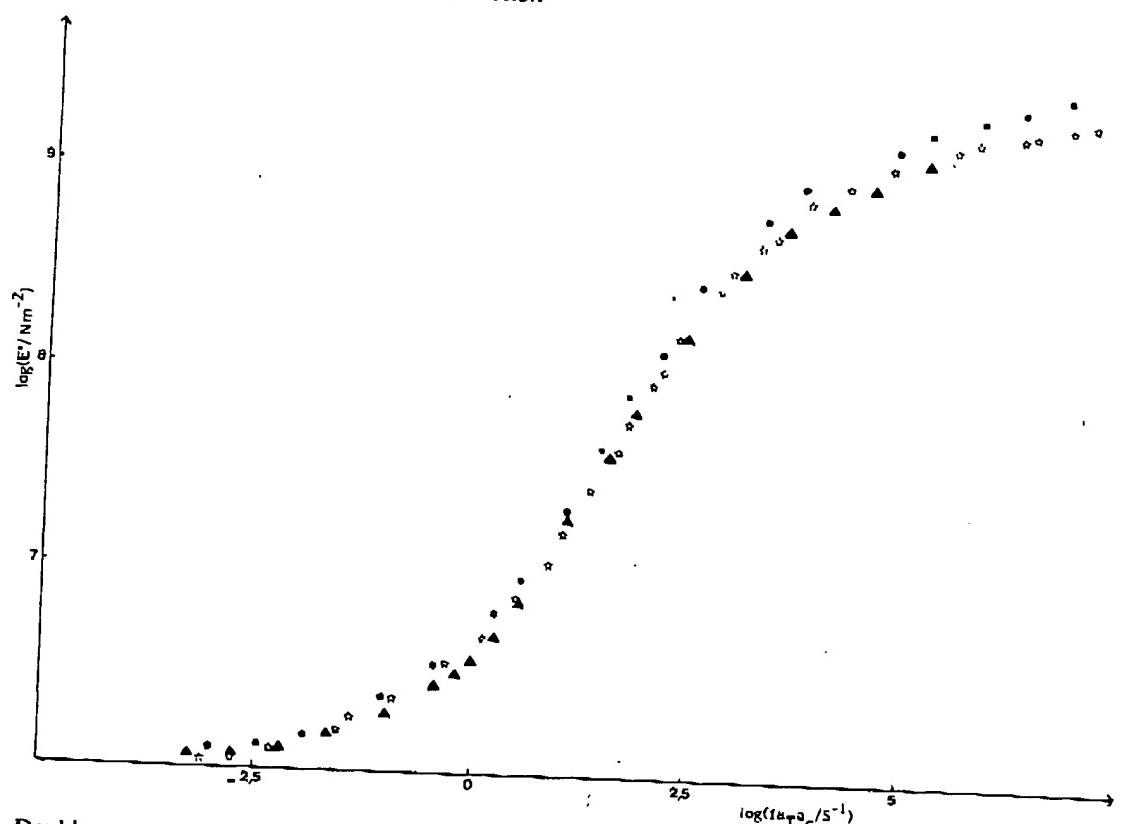


Fig. 7. Double master curve constructed from the three master curves (cf. Fig. 6) at different salt concentrations (cf. Table 3). The reference temperature is that corresponding to the maximum value of T_g in each case. a_c is the shift factor with respect to the salt concentration, viz. $a_c = \tau(c)/\tau(c_0)$ taken at the reference temperature with c_0 as reference concentration.

for a given anion; (v) the anion for a given alkali metal cation; and (vi) the overall nature of the ionic moiety, i.e. added salt or ionomers.^{18,25,28}

If the large body of evidence gathered in this study leaves no doubt about the free-volume origin of the ionic mobility, it is nevertheless important to point out that the measurements of ionic conductivity have provided another important insight into the microscopic interactions occurring within these systems. The ionic conductivity inside a polymer matrix is a function of both the concentration and the mobility of charged species. Because an increase in salt concentration induces an increase in the T_g of the network, the ionic mobility follows a trend opposite to that displayed by the abundance of charge carriers. In order to compensate for this dichotomy, it is necessary to correlate the measured conductivity values to the salt concentration at equal mobility, viz. at $(T - T_g) = \text{constant}$. When such plots are constructed, as shown in Fig. 8, three features become apparent: the linearity of the plots up to a critical salt concentration, the slope of these straight lines, and the occurrence of singularities above the critical concentration characterized by conductivity minima at specific values of the salt concentration.

These peculiarities have been analysed and interpreted quantitatively with a whole series of network-salt combinations.^{15,18,28} Suffice it to say here that the slope of these log-log plots is related to the relative importance of a given equilibrium of ionic dissociation with respect to the others, i.e. the

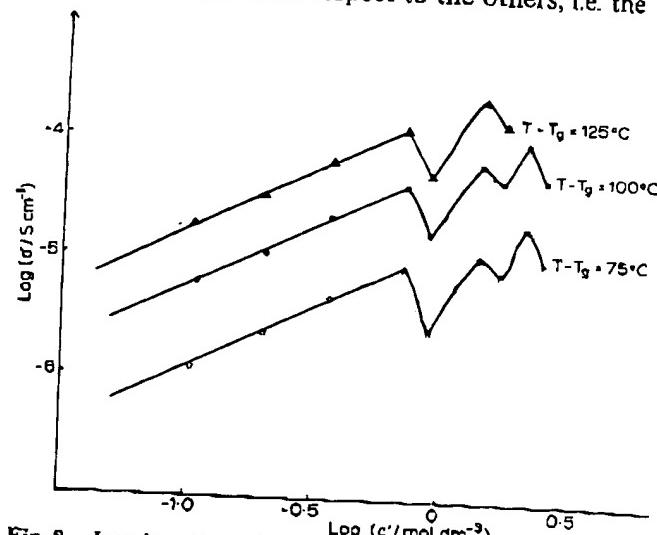
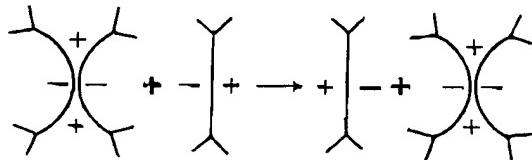


Fig. 8. Log-log plots of ionic conductivity σ versus LiClO_4 concentration c for three values of $T - T_g$.

possible predominance of a specific set of species (single ions, ion pairs, triplets, quadrupoles, ...). For example, the situation shown in Fig. 8 gives a slope of unity which implies that the lithium perchlorate present below the critical concentration yields mostly quadrupoles.^{18,21,28} This behaviour was found frequently in this study but is by no means general, other specific instances having also been observed.

The discontinuities, and in particular the minima of conductivity, were found to correspond to discrete values of the ratio between Li^+ and ether units in the chains. In the specific context of Fig. 8, the first minimum corresponds to one Li^+ per PEO chain ($M_n = 1050$), i.e. to its partition into two segments of about 12 ethylene oxide units each. The second minimum corresponds to two Li^+ per PEO chain, i.e. to a partition into three segments of about eight ethylene oxide units each. Similar observations were made with networks prepared with PEO of $M_n = 2100$.²⁸ The appearance of 'waves' such as those shown in Fig. 8 above the critical concentration, has been tentatively rationalized in terms of the attainment of ordered structures at each discrete ratio.²⁸

The concept of ion-dipole crosslinking, already put forward and discussed in previous sections, as a rather static representation, is corroborated here in a more dynamic framework. The following model attempts a microscopic visualization of the nature of these polar interactions between ions and other dipoles in the polyether chains and of the way segmental motions can induce the displacement of mobile charged species from one site to the next. The importance of such ionic transfers will inevitably depend on the frequency and amplitude of segmental motions, i.e. on the free volume available. These phenomena are random and they give rise to statistical concentration fluctuations at a microscopic level. When a potential difference is applied across the sample, the ionic transfers obviously become unidirectional and thus ensure ionic transport across the material.



3.6 Transport numbers

When a few years ago Sorenson⁵ first studied the cationic contribution to conductivity in a linear PEO and found transport numbers t_+ lower than 0.5, these results were met with some surprise because it was expected instead that t_+ should be close to unity. Since then, similar values have been obtained in

various laboratories and it is now generally accepted that the alkali metal cations contribute less than 50% of the ionic conductivity in a variety of systems.³

A first account of the determination of transport numbers within the context of crosslinked polyether networks was given in 1983.¹³ Further work in this laboratory, always using Tubandt's technique, has been carried out on a considerable number of systems, but only published in part.¹⁷

3.6.1 t_+ in ionomers. In the extreme situation in which the anions are covalently bound to the network, it was verified that the cationic transport number was indeed unity.²⁵ This obvious result has the merit of showing the validity of the experimental technique adopted for the determination of transport numbers.

3.6.2 Mobility of anions. In order to dispel any residual doubt about the mobility of relatively large anions, e.g. ClO_4^- , within a polyether matrix, an experiment was carried out in which a disc of PEO-based network containing potassium perchlorate was submitted to a rather intense electrolysis. Thereafter, this sample was analysed by X-ray fluorescence (detection of emission from Cl atoms) and a concentration profile established concerning the distribution of perchlorate anions across the disk. Figure 9 shows the results obtained which indicate clearly that an important migration of ClO_4^- ions towards the anode had taken place during the electrolysis.

Having established this basic feature, a more quantitative study was conducted on the mobility of the CF_3SO_3^- (triflate anion) by a spin-echo n.m.r. technique using pulsed field gradients applied to the ^{19}F nuclei. These experiments allowed the calculation of the self-diffusion coefficient of the anion (D^-): for a PEO-based network containing 16% lithium triflate, D^- was found to be $4.2 \times 10^{-8} \text{ cm}^2 \text{ s}^{-1}$ at 62°C. Swelling this system in chloroform produced an increase of the anionic self-diffusion coefficient of more than an order of magnitude.

The above tests demonstrate beyond doubt that typical anions do migrate readily inside a cross-linked polyether matrix.

3.6.3 A systematic study of the cationic transport numbers. Starting from a network system based on PEO and Desmodur R triisocyanate (Table 1), the influence of five variables was investigated in order to assess how t_+ was affected by them.

The influence of temperature on t_+ for a typical network containing LiClO_4 was found to be

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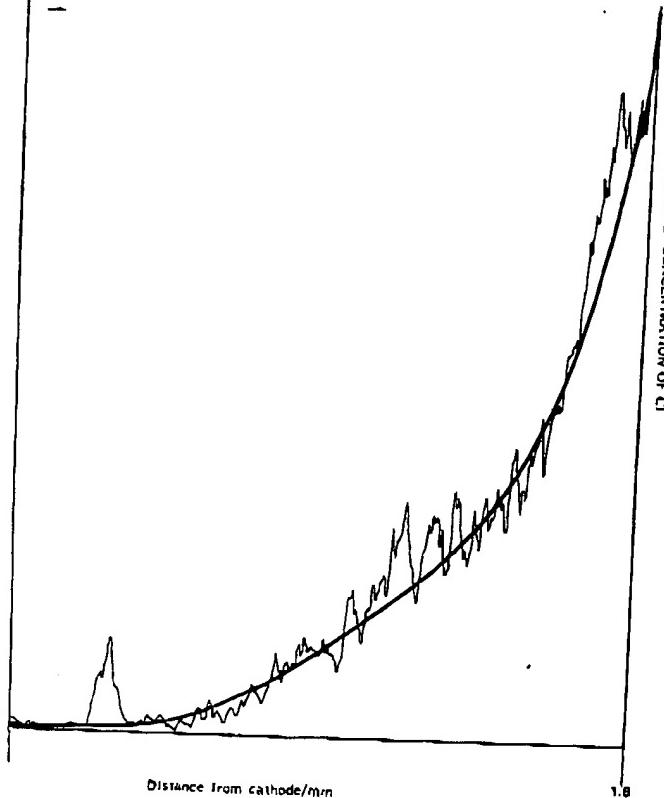


Fig. 9. Chlorine (ClO_4^-) concentration profile across a disc of crosslinked PEO, originally containing a uniform concentration of KClO_4 , after electrolysis. The plus and minus signs indicate the corresponding emplacements of the electrodes.

negligible, all values of t_+ falling within ± 0.02 in the temperature range 60–120°C.

For a given network-salt system, an increase in concentration of the salt produced a decrease of t_+ down to an asymptotic value. For example, with lithium perchlorate, Fig. 10 shows this trend, which is discussed below.

For a given network-salt combination, the DP of the PEO chains between crosslinks influences t_+ in that an increase of DP induces a decrease of t_+ as shown in Fig. 10. The two trends appearing in Fig. 10 reinforce the idea of chain partitioning by Li^+ . Here, a discontinuity is again found (cf. conductivity results) at one Li^+ per PEO chain ($M_n = 1050$) and at three Li^+ per PEO chain ($M_n = 2100$). Beyond these critical salt concentrations, t_+ becomes independent of this parameter. For a given network, the progressive increase in lithium perchlorate concentration produced a corresponding decrease in the number of ether sites available for complexation by Li^+ . The 'saturation points' correspond to the most favourable partitioning situations. Beyond these critical concentrations, the additional salt goes preferentially to the existing complexed sites to form

TABLE 4. Influence of the cation on the cationic transport number

Salt	% [cation]/[EO] ratio	t_+
LiClO_4	2.8	0.30
NaClO_4	2.8	0.17
KClO_4	2.8	0.20
AgClO_4	2.8	0.30
$\text{Mg}(\text{ClO}_4)_2$	2.2	0

higher ionic aggregates. For a given LiClO_4 concentration, the decrease of t_+ with the molecular weight of the polyether chains can be explained tentatively by arguing that a progressive reduction of the mesh size introduces a corresponding decrease of the perchlorate anion mobility, given its much larger bulkiness compared with that of the lithium cation.

For a given situation characterized by a given network containing salts with a set concentration and the same anion, a change in the nature of the monovalent metal cation produced the variations in t_+ shown in Table 4. The first important observation concerning these results is that the cationic transport number remains low for all situations studied. As for the influence of the type of cation on t_+ , no explicit trend is apparent. In the same table is reported the datum related to the absence of contribution to ionic conductivity in the case of the magnesium cation. This result suggests that the use of a small divalent cation introduces a very strong binding with the PEO chains. A comparative measurement of swelling at equilibrium by benzene of two identical networks, one filled with lithium perchlorate, the other with magnesium perchlorate, showed that in order to attain the same q value, the molar concentration of lithium perchlorate had to be double that of magnesium perchlorate. The scheme proposed above for the transport of lithium and perchlorate ions by polyether segmental motions implies the existence of quadrupoles at the crosslink. The present observations relating to the use of magnesium perchlorate are more conducive to an interpretation calling upon the more straightforward strong interaction between one salt molecule (ion pair) and two ether oxygen atoms belonging to two PEO chains.

The influence of the nature of the anion on t_+ , all other parameters being kept constant, is shown in Table 5 for two different sets of cations. The difference in the cationic transport number between sodium tetraphenyl borate and sodium perchlorate is readily explained in terms of the size of the anion. BPh_4^- has a volume about 15 times larger than that of ClO_4^- and as a consequence its transport number is likely to be reduced accordingly: the net result is

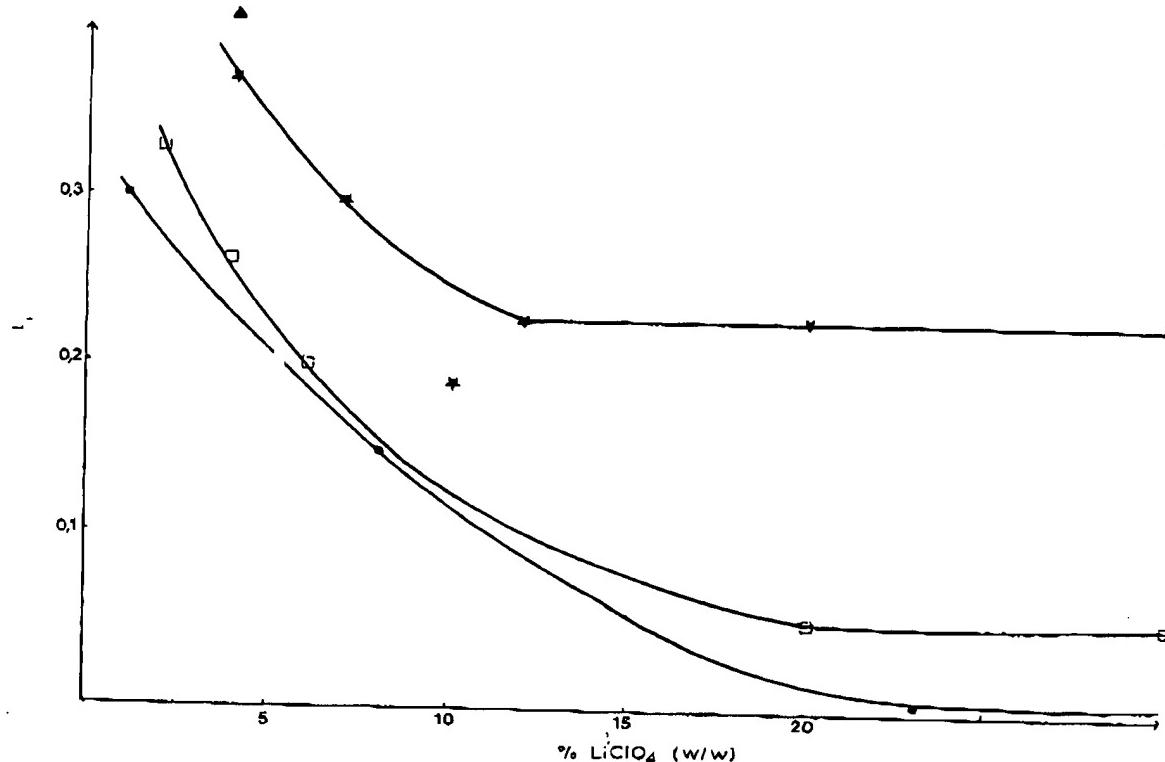


Fig. 10. Dependence of the cationic transport number on LiClO_4 concentration with three different PEO-based networks. ▲, networks based on PEO 420 and Desmodur R triisocyanate; ★, networks based on PEO 1050 and Desmodur R triisocyanate; □, networks based on PEO 2100 and Desmodur R triisocyanate; ●, networks based on PEO-b-PPO-b-PEO ($M_n = 4980$) and Desmodur R triisocyanate.

that t_+ increases relative to the value obtained with the perchlorate anion (cf. also Table 4).

The three results with lithium salts reported in Table 5 can be rationalized as follows: the identity of behaviour between lithium perchlorate and lithium triflate is explained on the basis of the similar pK_a of the parent acids and a similar size for the two anions. The increase in the cationic transport number occurring when lithium trifluoroacetate was tested (a salt possessing again an anion of a size comparable with those discussed above), could be due to a different extent of ionization coupled with a competitive affinity of the ether groups of PEO chains and the trifluoroacetate anions towards the lithium cations.

TABLE 5. Influence of the anion on the cationic transport number

Salt	% [cation]/[EO] ratio	t_+
LiClO_4	4.1	0.22
LiSO_3CF_3	4.1	0.21
LiCO_3CF_3	4.1	0.63
NaBPh_4	2.8	0.50
NaClO_4	2.8	0.17

Networks made up of polyether chains other than PEO were also investigated. The precursors were poly(propylene oxide) (PPO) glycols, PEO-b-PPO-b-PEO glycols and PDMS-g(PPO-b-PEO) polyols (cf. Table 1). After crosslinking with various multifunctional isocyanates, different metal salts were added. With PPO-based networks, the cationic transport number was systematically somewhat higher than with the corresponding PEO-based networks containing the same salts. Thus for example, under identical conditions, t_+ was 0.40 ± 0.02 instead of 0.31 ± 0.02 for the lithium cation. With the other networks, the values of t_+ were close to those measured in the context of PEO-based networks under the same conditions.

3.6.4 Conclusion. It can be asserted that it is now clear that most of the systems which represent interesting materials for the construction of solid-state batteries and which involve the combination of a polyether-based network plus an added salt are inevitably characterized by very low t_+ values, more often in the range of about 0.2 than around 0.5. This is not an artefact since the ionomers gave the correct answer of $t_+ = 1$ and no cationic conductance was observed with the magnesium cation. It follows that

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in order to reach an optimum performance of these solid electrolytes, the most adequate solution seems to be that of employing networks in which the cation is mobile whereas the anion is covalently bound as an intrinsic part of their structure.

3.7 Nuclear magnetic relaxation

Previous experiments in this laboratory concerning nuclear magnetic relaxation measurements dealt with ^7Li , from lithium perchlorate as added salt,¹¹ as well as ^1H , ^{11}B and ^{19}F , respectively, from the polyether chains, sodium tetraphenyl borate and lithium triflate.¹⁵ A short outline of more recent work has already been given.¹⁹

3.7.1 Relaxation of chain protons. A systematic investigation of the transversal relaxation (T_2^{-1}) of ^1H nuclei belonging to the PEO chains in networks containing lithium perchlorate²⁹ has shown that the salt has a stiffening effect on the network, thus confirming the corresponding increase in the glass transition temperature reported and discussed above. These results reaffirm the occurrence of interactions between lithium cations and polyether segments. A more detailed study showed that chain

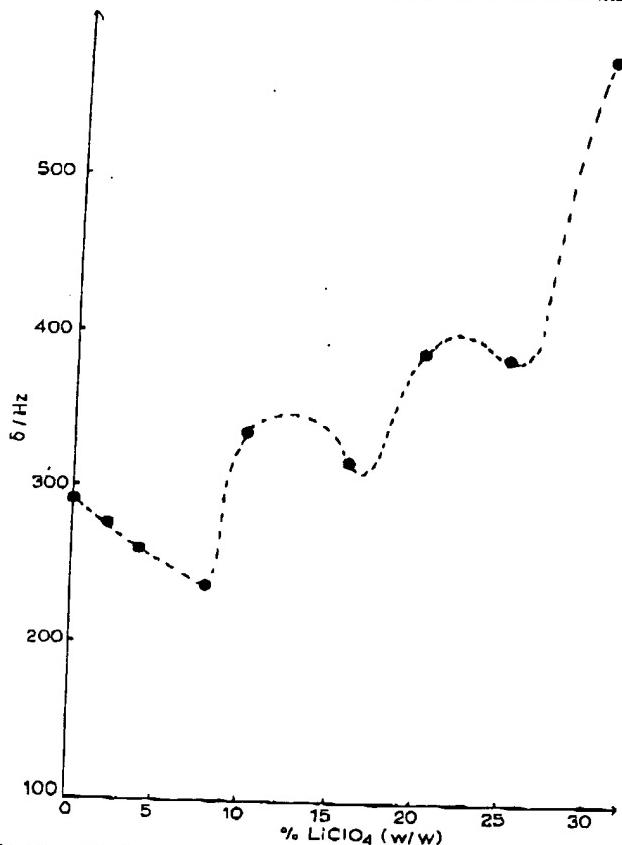


Fig. 11. Variations of the rate of transversal magnetic relaxation of PEO ^1H as a function of LiClO_4 concentration in a network based on PEO 1050 ($T = 343 \text{ K}$).

partitioning could be demonstrated independently by the present technique. Interestingly, Fig. 11 shows that this feature manifested itself as a wave-like function when the relaxation of protons was measured at high temperature, just as with the conductivity results at high salt concentration (cf. Fig. 8 and appropriate discussion). Here too, the minima in Fig. 11 correspond to one, two and three lithium cations per PEO chain ($M_n = 1050$), respectively. Both phenomena, which represent two alternative ways of observing the same microstructure, were only detected when operating at relatively high temperature, viz. above about 65°C . Measurements of the dielectric constant of these salt-plus-network systems using complex impedance diagrams indicated that ϵ increased dramatically when the temperature was increased. For example, the dielectric constant goes from ~ 8 at 20°C to ~ 500 at 70°C for a PEO-based network containing somewhat less than one lithium cation per PEO chain (the salt used was lithium perchlorate). This abrupt change with increasing temperature reflects the partial transformation of ionic quadrupoles around an ion-dipole crosslink characterized by a low overall polarity (see scheme above), into dipoles which on the contrary impart a high polarity to their surroundings.

3.7.2 Linewidth of lithium nuclei. The magnetic relaxation of ^7Li nuclei, detected through the linewidth δ of its resonance as a function of temperature, was studied with various networks based on PEO-b-PPO-b-PEO and PDMS-g(PPO-b-PEO) containing lithium perchlorate at different concentrations. Figure 12 is an Arrhenius-type plot for one such system. Towards the lower temperature regime, i.e. below the glass transition temperature of the system, the linewidth is high and constant and its value is close to that exhibited for ^7Li nuclei in metallic lithium. In this region the segmental motions are frozen and the spin-spin relaxation of the lithium nuclei is fast. As the temperature is increased, δ is reduced in the region corresponding to the glass transition. The narrowing of the linewidth is due to the incipient segmental motions which also entail the lithium cations. Finally, at still higher temperatures δ reaches a limiting lower value imposed artificially by instrumental effects, e.g. field inhomogeneity. The features noted here for Fig. 12 were also encountered with all other systems studied.

A WLF treatment of the transition zone of curves like those shown in Fig. 12, using a relaxation model based on free volume considerations rather than on activation energy, gave $C_1 = 8 \pm 1$ and $C_2 = 55 \pm 5 \text{ K}$, viz. values in close agreement with those obtained from both viscoelasticity and conductivity measurements.

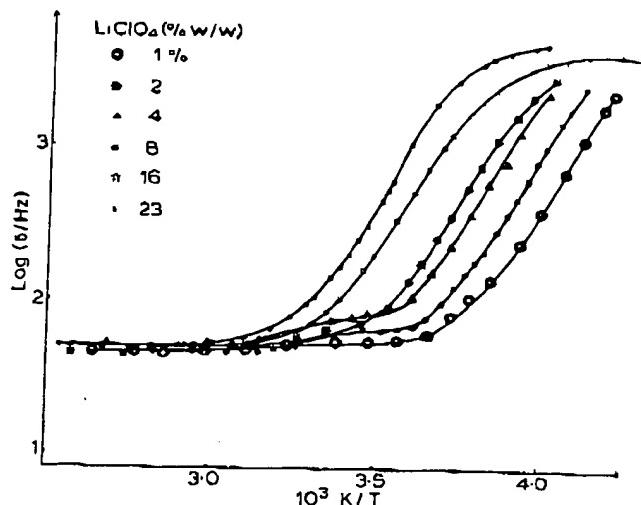


Fig. 12. Arrhenius-type plot of ${}^7\text{Li}$ n.m.r. linewidth for networks based on PEO-b-PPO-b-PEO ($M_n = 4980$, see Table I) containing different concentrations of LiClO_4 .

3.8 Electrochemical stability and applications

It is obvious that the possible use of these conducting systems as electrolytes for solid-state cells requires the study of their range of redox stability. In fact, the electrolyte must play exclusively its specific role as medium for the transport of ionic carriers between the two electrodes without suffering any modification induced by electrochemical reactions upon it. In the present investigation, tests were carried out using classical cyclic voltammetry techniques.^{14,20} The materials tested consisted of polyether-urethane networks containing lithium perchlorate.

Figure 13 shows a typical cycle; the stability limits are clearly imposed by the reduction potential of the lithium cation on one side and by the oxidation potential of the perchlorate anion on the other. This gives a useful stability range of about 4 V. In all these experiments no electrochemical process pertaining to the electrolyte or affecting it was ever detected. This is an important practical finding which suggests that the polyether-urethane networks chosen are stable. In order to confirm this conclusion, dry samples of networks with and without added salt were placed in contact with metallic lithium by pressing them together under an argon atmosphere for 1 month. After this prolonged adhesion the two elements were separated: the lithium surface appeared unchanged and the networks exhibited the same electrical and mechanical properties as tested before the experiment. Thus, it seems reasonable to conclude that these materials and more particularly the urethane groups are electrochemically inert in the conditions relevant to the present context.

It became therefore appropriate to examine the

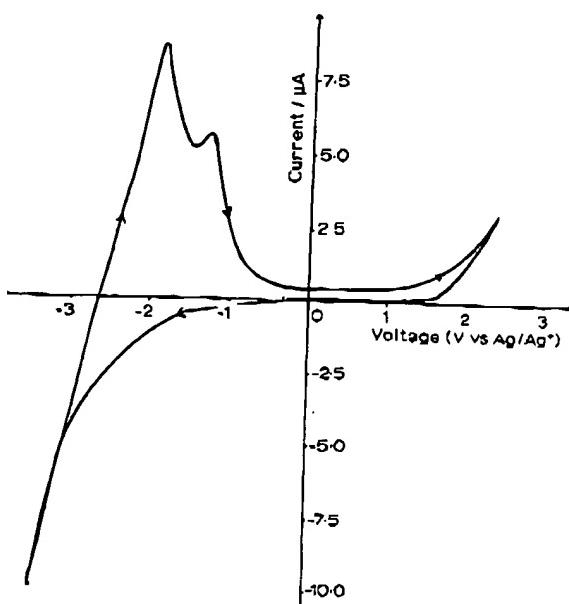
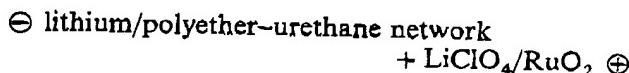


Fig. 13. Cyclic voltammetry applied to a network based on PEO ($M_n = 2100$) and Desmodur R triisocyanate, containing 20% (w/w) LiClO_4 . Sweep rate: 40 mV s^{-1} ; $T = 343 \text{ K}$. The small peak near -1 V which follows the reoxidation of Li is due to the well-known Li-Pt alloy (the working electrode was made of Pt).

response of these materials as solid electrolytes in a proper battery set-up since they coupled high ionic conductivities with electrochemical stability. The cell adopted was^{14,20}



where RuO_2 was the material used as insertion electrode for lithium cations. From the behaviour recorded with two cycles of discharge-charge, it was concluded that the polymer-salt systems showed a good performance. Their application seems therefore entirely possible although the maximum current densities allowed were lower than $100 \mu\text{A cm}^{-2}$. This limitation is a direct result of the fact that the ionic transport in these systems is mostly due to the anion and thus justifies the research work on ionomer networks. Our activity has been outlined in the various sections above. The results seem encouraging as shown in Fig. 14 where conductivity plots obtained with different ionomeric networks are compared with the behaviour of a typical network-plus-salt system under similar conditions and with the same cation. The values with dry phosphate and thiophosphate anions are rather low, but can be enhanced by swelling with an appropriate polar liquid. Anions simulating the trifluoroacetate anion also give relatively low conductivities because of the modest degree of dissociation to give free lithium cations. The alcoholates complexed with a Lewis

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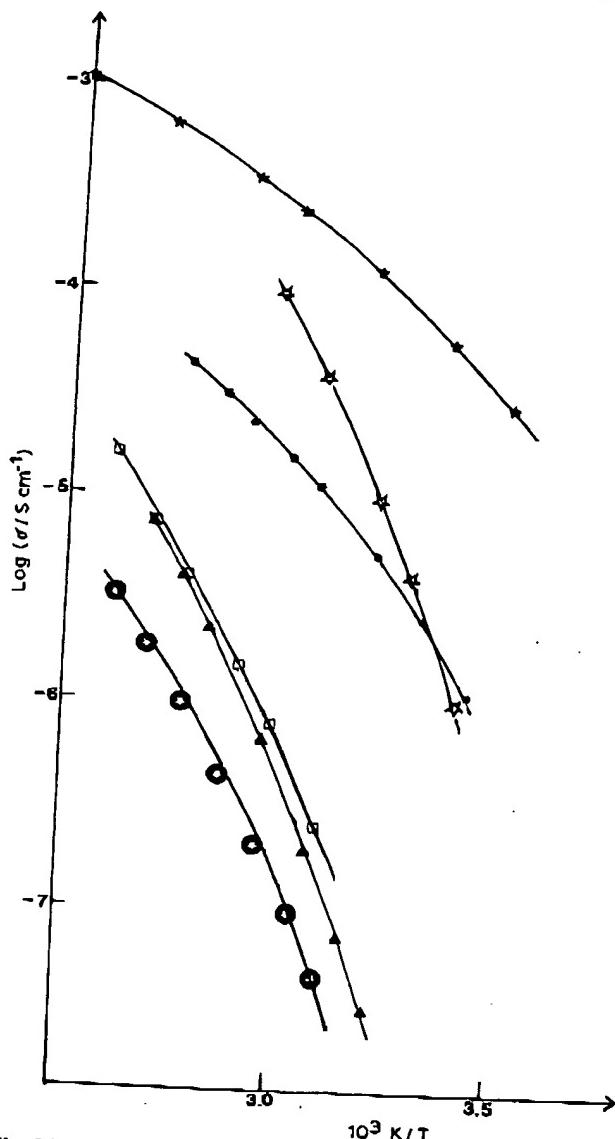


Fig. 14. Comparison of the conductivity behaviour of various ionomeric networks with that of a network-plus-salt system. ★, Polyether network based on PEO-b-PPO-b-PEO ($M_n = 8390$, see Table 1) containing 12% LiClO_4 (w/w);²⁸ ○, polyether-phosphate network with Li^+ ;²⁵ ★, system ● swollen with 40% propylene carbonate (w/w);²⁵ ●, polyether network based on PPO triol (see Table 1) containing lithium alcoholate functions dissociated by SbCl_5 (see Experimental part);²⁶ ▲, polyether network based on PPO triol (see Table 1) containing $-(\text{CF}_2)_3\text{COO}^- \text{Li}^+$ functions (see Experimental part);²⁶ □, polyether-thiophosphate network with Li^+ .²⁵

acid give the most satisfactory results although clearly more work is needed to attain the desired performance.

4 CONCLUSIONS

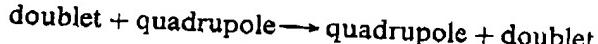
This investigation has provided a much deeper understanding of the properties and behaviour of

solid electrolytes consisting of polyether-urethane networks with either a dissociated salt added to them or anionic moieties covalently attached to their structure with the cationic counterparts free to move within the polymeric matrix.

In particular, it has become clear that the free volume theory (WLF) of polymeric matter above the glass transition temperature applies to these systems in the specific context of the mobility and transport of ionic species. This was proven by the excellent agreement found for the values of the C_1 and C_2 WLF coefficients obtained from very different experimental approaches, not only the classical viscoelastic measurements but also the conductivity data and magnetic relaxation results pertaining to nuclei of both the polymer chains and the added salts. It follows that one of the basic criteria to attain a high ionic conductivity is a system with as low a glass transition temperature as possible. Coupled with this concept, one must of course take into account two other basic requirements: the solubility or thermodynamic compatibility between network and salt and the high degree of dissociation of the salt. The systems chosen here responded quite adequately to these guidelines, as shown by their satisfactory performance as solid electrolytes in a battery set-up.

The only drawback lies of course in the surprisingly low contribution of the cations to the overall ionic conductivity in the context of networks in which the salts were added separately. The investigation programme on ionomeric networks with fixed anions was conceived and initiated precisely to improve this situation, whilst keeping the other advantages at optimum level. This activity is still being pursued.

On a more fundamental basis, the multidisciplinary approach which characterized this project also proved particularly rewarding. It was in fact possible to draw important conclusions concerning the interactions between ionic entities arising from the added salts and the ether groups on the polymer chains and concerning the nature and relative proportion of different ionic aggregates as a function of the major variables. The combination of all these pieces of information provided a valuable insight into the way ions can move within the polymeric network. Segmental motions of chains bearing complexed ionic moieties lead to possible concerted exchanges of the type



The ensuing charge fluctuation (provided by specific anionic or cationic point defaults) becomes an oriented migration when an electric field is applied across the sample. The anions are transported more readily than the cations if both entities are free to

move and if the former are not too bulky. This is due to the fact that anions are less subject to complexation with elements of the polymer chain than cations.

As expected, if the anions are chemically anchored to the network structure, only cationic transport is observed. This situation deserves further study because it represents the best potential for future application. Work is in progress to fulfil that aim.

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